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ELECTRICITY IN STEEL-MAKING.

Iron and steel are used to a greater extent in the upbuilding of the material side of our civilization than any other metals, and even yet it is impossible to comprehend fully the tremendous impetus toward this world-wide civilization created by the introduction of high-grade commercial steel. Scarcely less impressive has been the remarkable development of the electrical industry and the practical application of electric power in every branch of iron and steel manufacture.

Some conception of the unprecedented growth and present magnitude of the steel industry can be obtained from carefully compiled returns for the year ending December 31, 1911, which indicate a total production of steel in the United States in excess of 23,600,000 gross tons. To a great extent this development has been due to the far-sighted policy of discarding paying processes and good machinery, sometimes while yet practically new, for newer methods and more efficient machines which promised still greater economies of production. In other words, the rapid advances in steel production were co-incident with advances made in the commercial application of electricity to the manufacturing processes involved.

Motor drive for the auxiliary apparatus of steel mills, such as transfer tables, screw-downs, cranes, hoists, charging machines, shears, etc., has been in use for perhaps 20 years. The application of motors to the main rolls, however, is a comparatively new step, but one which indicates great possibilities for the future. As an example, during the past five years there have been approximately 140,000 horsepower in main-roll motors installed in the United States, while for Great Britain this figure is considerably exceeded.

It will be seen, therefore, that while this popularity of motor drive does not necessarily mean that its superiority over steam driving is generally established so as to apply in all cases, there are certainly a great number of cases where the motor is preferred.

When more extensive reliable data are available as to the performances of electric motors in steel mills, it is safe to predict that motor drive will soon become universally adopted, even for the more severe classes of service. It follows then that considerable importance attaches to the question of central-station versus isolated-plant supply. This question is discussed, in a limited way, in the article on "Electricity

in Iron and Steel Mills," appearing elsewhere in this issue. Operating data on four mills purchasing energy from central stations, which are presented, are of particular interest, as comparisons with steam-driven plants can readily be made.

Central-station companies are fast realizing the mutual advantages which contracts with the various steel plants afford. The results obtained by the motor-operated plants have been carefully analyzed and the operating conditions and requirements definitely established. This is a decided point of advantage as compared with steam-engine drive.

With the conditions outlined, the power companies have a definite basis on which to establish their proposals, and they are finding, in a majority of cases, they can well afford to make a rate for power which is advantageous to the steel plants. In this respect England has taken the lead. In Birmingham alone some 32,000 kilowatts are installed for the generation of electrical energy for iron and steel mills. The operators in this district were at first skeptical as to the economies to be derived, but the initial installations have proved conclusively that large savings are to be effected.

One of the strongest arguments that can be advanced in favor of central-station power is its reliability. In no other industry is absolute continuity of process such an imperative consideration. The financial loss resulting from the temporary shutdown of the main rolls is estimated at from $400 to $1,000 per hour, depending on the nature of the work involved. It is obvious, therefore, that the guarantee of continuity of service which the central station can make is of considerable weight.

GRAPHIC METHODS IN THE CONTRACT DEPARTMENT.

Few central stations are as yet utilizing graphic methods in the work of their contract departments to the extent which is warranted by their convenience and ease of interpretation. There is a good opportunity here for work which will interest the public as well as the employees of a growing company. The average man quickly learns to appreciate the lesson of a curve or straight-line diagram showing the increase in the connected load from month to month, or even from week to week, in a company where things are moving fast, and if such diagrams are placed before him now and then near the cashier's window where he pays his bills, or even printed on small sheets and inclosed with the bills, they are bound to receive attention and accomplish some really high-class advertising.

Thus, if a company is making a special effort to capture the business of small power users, it is interesting to plot a curve showing the gain in motors of this sort connected to the system on a time basis, and to let each customer see how others are falling into line and taking service. Here is real material for advertising—the kind which looks interesting to the layman and technical man alike—and it is a good deal more convincing than the same information expressed in tables. Most people are greatly influenced by what others in the same line of work are doing, and if Smith, who owns a small machine shop run by steam power, with all its attendant annoyances and costs, hears and sees that a good many Joneses and Browns are signing up for the motor drive as indicated by published statements and diagrams prepared by the central-station company, there is no question that his receptivity is increased mightily, so that when the contract man from the company calls he finds a much more willing listener.

Similarly, the increase in the number of consumers taking flat-rate house or commercial lighting, or the gain from week to week in those using washing machines, flat irons, electric pleasure cars or almost any other current-consuming device, affords suggestive materials for graphic publicity at the company's office, in the local press or in correspondence. It is a point worth remembering that whenever a successful campaign for new business is launched, the rate of increase in the early stages is often very rapid, and even if the total amount of new business secured in a given time is not very large, the rate of gaining is apt to show off very handsomely on a diagram. After awhile, if the increase drops off unduly, indicating that for the time being the saturation point of the community is being approached, it is not necessary to continue the publication of such records, and some other line of attack may be selected. It should not be forgotten that the rate of growth can be shown practically as well on diagrams showing percentage increases as on actual amounts secured, if the initial figures seem too small to publish.

Within the sales department little argument should be needed to demonstrate the value of graphic methods. Trained men engaged in the sale of electric power, the securing of lighting contracts, and other such work always see at a glance the lessons of the progress diagram. Where daily conferences are a feature of the contract department's service, the plan of plotting upon a large wall chart from morning to morning the gains of business in the past 24 hours, and losses, if any, is an excellent way in which to stimulate the efforts of the staff and keep interest at a high point. The value of checks of this kind upon personal effort is much greater than is sometimes realized. Such charts can be made to show the weak spots of the campaign in a way which mere figures seldom indicate; they save the time of executives and may be used to compare individual performances no less than totals. That most companies appear to have done little along these lines is no reason why the possibilities should be overlooked, and we hope that the near future will witness a greater development of this promising field of graphic analysis.

BILLBOARD LIGHTING.

Only a brief investigation of the field of billboard lighting is necessary to demonstrate its value to a central station as a consumer of long-hour service. The amount of energy required to properly light a billboard of considerable size is small, and this in itself is sufficient reason for a much larger development than the average city enjoys at present. Depending upon the number of lamps used and the type of reflectors adopted, the surface which can be displayed to advantage with a given expenditure of energy varies widely. Thus, six 100-watt tungsten lamps will brilliantly illuminate a narrow board say 20 feet long and 7.5 feet high, while the same installation differently arranged will provide a fairly good illumination even for a board 30 feet high and 40 feet long. In the first case, if the lamps are placed in pairs in front of enameled reflectors located above and to the front of the board, the lighting will be conspicuously good; in the second, with eight times the surface to cover, six lamps hung before individual reflectors placed in two horizontal rows near the middle of the board will at least attract attention and facilitate the reading of the advertisement, although if the locality has many electric signs or spectacular windows well equipped, it may be worth while to consider a higher intensity of illumination.

Through co-operation with local billboard houses, the central station should secure the most satisfactory development of this business. To the manager accustomed to strike for large installations the business may appear of trifling importance, but even if it brings in but a few cents an hour in each case, it all helps in the aggregate, and in a single neighborhood will soon amount to $100 a month with anything like aggressive soliciting. Six cents an hour is a small sum to the advertiser for the publicity which electric lighting gives him, where only 600 watts are consumed at a single board, but it means in the neighborhood of $10 a month to the lighting company for every such installation, and is good business even where this price includes lamp renewals and the loan of reflectors. Billboard lighting rests on a solid foundation—the natural tendency of everyone to look out of the darkness to an illuminated object—and the more installations there are of this kind, the less effective those unprovided with artificial illumination become by contrast. For this reason a broad policy is desirable in introducing this class of business, and the use of a central-station billboard, advertising the work and facilities of the lighting and power company, or the gratuitous supply of energy to a board stating the commercial or manufacturing facilities of the local community, is a good object lesson. The tungsten lamp is absolutely necessary to the best results, since nothing like the same effects could be secured by the use of carbon incandescents of the same total wattage. Imagine trying to illuminate 1,500 square feet of board with twelve ordinary 16-candlepower units under city roof conditions!

The future of billboard lighting seems fairly well assured, provided the canons of good taste in advertising are maintained. There is room for a broader investigation of the relation of color effects to the number, size and disposition of lighting units and reflectors, the possibilities of using lighter backgrounds to multiply the powers of the reflecting surface of the board itself, the improvement of wiring and the betterment of mechanical conditions bearing upon the support of the structure. Both local and national advertisers can utilize this sort of publicity to great advantage, and in proportion to the revenue derived, the investment required by the central station to meet the energy demand is ordinarily very small. The load comes on the lighting peak, it is true, but the time is not far away when the diversified service of the modern central station will cause the yearly maximum to assume much less influence upon the plant than it has in the older days. Thousands of billboards are now in nightly eclipse all over the country which might easily be netting the central station a handsome annual revenue, and when the low cost of this service is more generally realized, the conditions now prevailing will undoubtedly be revolutionized.

MAGNETIC SYMBOLS.

One of the aims of the International Electrotechnical Commission is to arrive at an agreement upon symbols for representing electrical quantities which can be used internationally, and thus secure uniformity in the expression of electrical relations in the form of mathematical formulas and equations.

One of the committees appointed by the Commission is a Committee on Symbols, and at the time of the Turin Congress acceptance was made of the proposals of this committee for the symbols E, I and R for electromotive force, current and resistance, respectively. There was already general agreement upon some of the other units, such as L for inductance and Q for quantity. For magnetic quantities the committee had recommended the use of Gothic or script capitals. At the meeting of the committee last month in Zürich considerable discussion arose upon the latter point, owing to the desire in some quarters, especially in Germany, to retain script letters for representing vector quantities as distinguished from scalar quantities. It is apparent that the final adoption of script letters for magnetic quantities will meet with considerable opposition, and, indeed, there seems to be little reason why they should be retained, unless identical letters of a different font are used for representing other quantities. Since the committee has modified its list of symbols to avoid such duplication, the use of script letters for the magnetic quantities might well be abandoned. There is little ground for singling out the magnetic quantities for a distinction of this character, aside from the matter of precedent. The script letters have already been used to a considerable extent, but little difficulty on this score would arise through a change, especially as present practice is not uniform.

Successful Meeting of New York Section.

On February 12 a joint meeting of the New York Section, Illuminating Engineering Society, and the Municipal Art Society was held, at which C. F. Lacombe, engineer of the Department of Water Supply, Gas and Electricity, presented a very able paper on "Municipal Street Lighting and Fixtures." In addition to this paper, Arthur Williams spoke on the general lighting situation in New York City. William Wentz, vice-president of the O. J. Gude Company, talked on "The Electric-Sign Situation in New York." Charles R. Lamb talked on "Decorative Lighting of Public Buildings."

The meeting was a pronounced success and the hall of the National Arts Club, where the meeting was held, was filled to its capacity with a very enthusiastic audience. Preceding the meeting, the Illuminating Engineering Society gave a dinner which was well attended.

The next meeting of the Section will be held on March 13 in the Engineering Societies Building, and will be a joint meeting with the Society of Mechanical Engineers, the American Museum of Safety and the Society for the Conservation of Vision.

Smoker of New York Electrical Society.

The New York Electrical Society held a meeting and smoker in the Engineering Societies Building, New York City, on the evening of February 17. The smoker was preceded by addresses by William J. Hammer and Antoine Pollak. Mr. Hammer spoke of his collection of incandescent lamps, which is one of the most remarkable exhibits in the history of the electrical industry. He sketched briefly some of the salient points in the development of the incandescent lamp, which is shown so clearly and connectedly by this collection.

Mr. Pollak described the Pollak-Virag rapid telegraph. In this system the telephone diaphragm is used as a receiver, in connection with a mirror. A beam of light falling upon the latter indicates the almost imperceptible displacement of the diaphragm by projecting a spot of light on a band of photographic paper. A great advantage claimed for this system is its rapidity.

The smoker was held in the rooms of the American Institute of Electrical Engineers and an able address was given by the new president, Henry L. Doherty, who reviewed in a most interesting way the progress of the Society and its special objects. The meeting was largely attended.

The Philosophy of Investment.

Investments in public-service securities were recommended as safe and sane by Charles G. Dawes, well known Chicago banker, in the course of an address before the Electric Club of Chicago, February 13, on "The Philosophy of Investment." Mr. Dawes interestingly explained the methods used to attract the public to questionable investments and stated that a fundamental rule to be guided by when desiring to invest is to invest with a man who has made a success of a business, and in the business in which he has made a success.

Comparing investments in public-service securities with real-estate investments, Mr. Dawes pointed out that the value of an office building, for instance, depends largely upon the traffic passing that building. Should this traffic be diverted to other localities, as often happens, the value would decrease. On the other hand, the public-service company extends its system to meet the changing conditions.

In reply to a question of W. E. Keily, Mr. Dawes said that state regulation of public utilities, impending in many states, should not detract from the value of public-service securities. If commissions are appointed without relation to politics no bad effects will result. Mr. Dawes favored a 10-percent return on the investment and also long-term franchises and monopolies for public-service companies.

Reception and Ball of American Institute of Electrical Engineers.

The reception and ball at the Hotel Astor, New York City, will be the closing feature of the midwinter convention of the American Institute of Electrical Engineers. It will begin at 9:00 p. m., February 28, and as it takes the place of the annual banquet, it will be the social event of the season.

Tickets to the reception, at $2.50 each, may be obtained from Ralph W. Pope, honorary secretary of the Institute, or at the Information Bureau of the convention, 33 West Thirty-ninth Street, New York.

Jovians Affiliated with San Francisco League.

At a meeting of the San Francisco Electrical Development League, held on February 11, the report of the committee appointed at a previous meeting to formulate plans for the affiliation of the Jovians Lunch Club with the League was adopted. The amended constitution and by-laws will come up for consideration and final action at a special meeting which has been called for February 25, 12:15 p. m., at Tait's Cafe, San Francisco, Cal.

Celebration of Minneapolis Jovians.

On Friday evening, January 31, the Minneapolis members of the Jovian Order held a rejuvenation in the Odd Fellows' Hall in that city, at which 26 candidates were initiated. Among these were Wallace G. Nye, mayor of the city, F. W. Springer and George D. Shephardson, professors in the University of Minnesota. The rejuvenation was followed by a buffet luncheon, and after this a program of vaudeville and burlesque acts was staged. The rejuvenation was attended by about 150 members, and the entire celebration was highly successful.

The Jovian Order in Minneapolis and St. Paul now has a membership of nearly 250 electrical men, and in each city a luncheon is held every other Tuesday at noon, at which prominent speakers deliver short addresses upon subjects interesting to the electrical fraternity. To these luncheons the friends of the Jovians, as well as the Jovians themselves, are welcomed. C. E. Hansing, of Minneapolis, is stateman.

Boston Motor Car Club.

The Electric Motor Car Club of Boston, Mass., held its bi-weekly dinner at Hotel Plaza, Boston, February 13. The discussion which followed the dinner was devoted mainly to plans for advertising and publicity. Several speakers discussed the motor shows at Chicago and New York, and the coming show to be held in Boston in March, with particular reference to the display of electric vehicles, which will be a prominent feature of both the truck and pleasure-vehicle divisions.

Edison's Kinetophone Introduced.

The kinetophone, Edison's latest invention, was successfully introduced in several theaters in New York City last Monday afternoon. It provides really perfect synchronism of voice and action. Large audiences were suprised and delighted. Two films were presented, one being a lecturer, who described and demonstrated the invention, and the other an old-fashioned minstrel show. A modern play is to be given later. Mr. Edison was present and was enthusiastically congratulated.

Meeting of Baltimore Jovians.

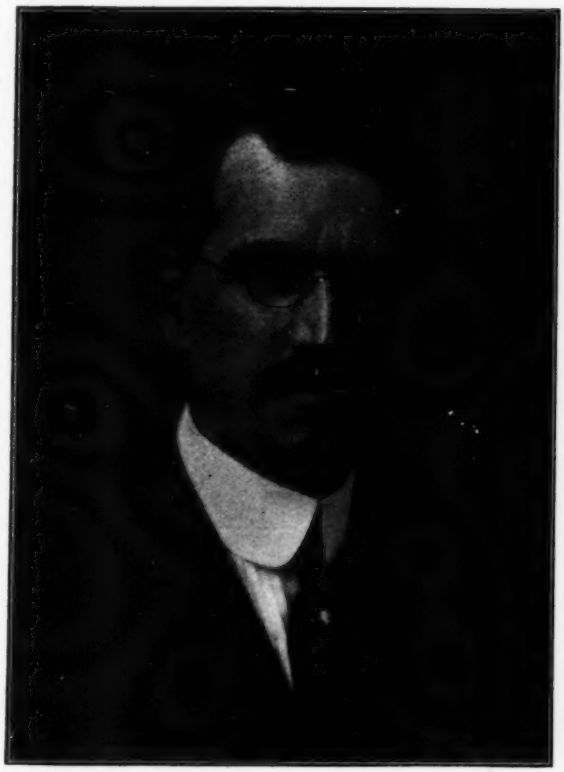
At the weekly luncheon meeting of the Jovians held at the Hotel Emerson, Baltimore, Md., on February 13, an address was made by Herbert A. Wagner, vice-president, Consolidated Gas, Electric Light & Power Company. Mr. Wagner spoke on the subject of rates. Melvin H. Jones, statesman for Maryland, presided.

W. B. Jackson.

William Benjamin Jackson, the subject of this sketch, has been trained for the profession of consulting engineer through a wide and varied range of experience. Mr. Jackson graduated in 1890 from the course of mechanical engineering at the Pennsylvania State College as a Bachelor of Science. Five years later he received the degree of Mechanical Engineer on account of work in the field and thesis. He was with the El Paso County Bank in Colorado Springs from 1890 to 1893, and for a year after this was in charge of the Pennsylvania mining exhibit at the Chicago World's Fair. At the close of the fair he reinstalled this exhibit at Pennsylvania State College, and later spent a few months in study upon electrical subjects at that institution. He was for a short time with the United Electric Light & Power Company of New York City as inspector during the construction of the Twenty-eighth Street Station and later in the year accepted a position with the Stanley Electric Manufacturing Company. After a brief service in the shops and testing department he became engineer in charge of the specification department. In 1895 he was transferred to Chicago as engineer for the Northwest in charge of all plant installation and engineering work in that district for the company. During this time he was in personal charge of the completion and the starting up of the Lowell-Grand Rapids Power Transmission in Michigan, transmitting two-phase electric current at 12,000 volts from Lowell to Grand Rapids. This was the first plant to be started east of the Rocky Mountains transmitting energy at so high a pressure. At the instance of the Stanley Electric Manufacturing Company he undertook the management of the Lowell plant in 1896, becoming manager and chief engineer of the Lowell Water & Light Company and the Peninsula Light, Power & Heating Company of Grand Rapids. At this time he developed an improved method of charging for light and power wherein a uniform basic charge is made per unit of translating devices operated by the consumer, to which is added an equitable charge for each unit of power actually used. He also devised means for working upon the live circuits of the high-tension transmission line, replacing the line insulators while the line was in service.

He re-entered the immediate employ of the Stanley Electric Manufacturing Company in 1897, and undertook the installation and testing of the two-phase alternating-current generating sets at the West New Brighton plant of the New York & Staten Island Electric Company. He later on assumed the duty of superintendent and chief engineer of the system.

In 1899 Mr. Jackson became general superintendent and chief engineer of the Colorado Electric Power Company, overcoming a number of exceptionally troublesome electrical paralleling problems with alternating-current engine generator sets. He devised means for working upon the live 20,000-volt transmission lines and not only changed the insulators and installed new transformer connections on the live circuits, but had the entire poles and crossarms replaced when damaged by storms, or otherwise, without hitch or shutdown, or injury to employees.



William B. Jackson,
Prominent Consulting Engineer.

He became connected with the Stanley Electric Manufacturing Company again in 1901, as traveling engineer, working on the details of the complete electrical equipment, including the making of estimates and specifications, for the 20,000-horsepower hydroelectric generating station of the York Haven Water & Power Company on the Susquehanna River. Most of his time as traveling engineer for the company was occupied in general engineering work, comprising largely the examination of power projects as to their improvement, reorganization or development, and especially as to the value of established and prospective hydroelectric developments, and as to the best methods of bringing them into commercial shape.

Mr. Jackson left the Stanley company and became associated with Dugald C. Jackson of Madison, Wis., in the consulting engineering business under the firm name of D. C. & William B. Jackson, in 1902. Since then he has given his entire time to the affairs of the firm, which moved its offices from Madison and established its main office in Chicago in 1907, shortly thereafter establishing a second office in Boston.

Mr. Jackson is a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers (a manager of the former and a member of the council of the latter), the American Society of Civil Engineers, the American Gas Institute, the Western Society of Engineers, the National Electric Light Association, the American Electric Railway Association and several other national and local engineering organizations.

His clubs are the Union League, Mid Day, Engineers and City of Chicago, the Homewood Country Club, the Association of Commerce of Chicago, the University Club of Milwaukee, and the Engineers Club and Exchange Club, both of Boston.

Large Electrochemical Power Consumption in Norway.

Over one-half of the electric power generated in Norway is used for electrochemical and electrometallurgical purposes. The total number of electric generating stations, according to official reports for the year 1911-1912, was 1,230, aggregating 417,607 kilowatts. Of this amount 211,131 kilowatts is employed for electrochemical and electrometallurgical purposes, 126,568 kilowatts for mechanical purposes, including electric traction, and the remainder for lighting and miscellaneous purposes. The result is an exceptionally high load-factor.

Comparative Performances of Horse, Electric and Gasoline Trucks in City Service.

The work which the Massachusetts Institute of Technology is doing in connection with a study of the comparative performances of horse, electric and gasoline vehicles was outlined by H. F. Thomson, of the Institute, before the Chicago Section of the Electric Vehicle Association of America, on February 18. Mr. Thomson referred to the inception of this work in May, 1911, which was made possible by an appropriation of the Edison Electric Illuminating Company of Boston. It has been the aim of those engaged in this research at the Massachusetts institution to divide the work under two general heads. First, the collection and compilation of operating costs and, second, a study of performances.

Results obtained from tests to determine comparative costs were presented in a paper read before the convention of the Electric Vehicle Association recently. In connection with vehicle performances, Mr. Thomson stated that the type of vehicle used in any service is dependent upon the class of service to be performed. Also, the amount of work which any type of vehicle can do depends upon the mileage and the standing time, or, in other words, time consumed by stoppages.

In comparing relative performances of horse-drawn with power vehicles, the most prominent advantage of the latter is its ability to arrive and depart from loading platforms, etc., especially under congested traffic conditions, with a minimum loss of time. The routing of vehicles is of great importance if maximum efficiency is to be obtained. It often happens that the power vehicle will show to no better advantage than a horse-drawn vehicle, unless the particular service which is being met is given consideration and routes arranged so as to take advantage of the salient features of the power wagon.

In studying the performances of vehicles three factors must be considered. These are mileage-factor, the ratio of the rated mileage of the machine to the actual mileage run; load-factor, the ratio of the rated capacity to the actual load which is carried; and moving factor, which is the ratio of the total time to the time consumed by stoppages.

Mr. Thomson referred briefly to tests made in Boston under the auspices of the Massachusetts Institute to determine the comparative performances of horse, electric and gasoline wagons in city service. Results of these tests were plotted and the resultant curves were shown by the speaker. Lantern slides illustrating various types of electric vehicles under varying conditions of service were also shown.

The results of tests given by Mr. Thompson indicated that hardly without exception the horse-drawn vehicle can be replaced by power vehicles with decided economies. Also, there is a clearly defined field for both the electric and the gasoline machine. However, as most of the tests referred to were conducted on vehicles making short hauls, the electric was shown to advantage.

Introducing the speaker, George H. Jones, chairman of the Section, stated that actual conditions were frequently exaggerated in the desire to make a sale. He deplored this condition and stated that he did not think it necessary to inflate values to sell electric vehicles.

Program of Conference of Society for Electrical Development.

The Society for Electrical Development, Incorporated, will hold a conference in the Engineering Societies' Building, 29 West Thirty-Ninth Street, New York City, on March 4 and 5.

This society has been organized to assist in the development of the electrical industry throughout the country, and to promote a more rapid increase, by the public, in the uses of electricity and electrical appliances for light, heat and power.

It has the support and endorsement of the National Electric Light Association, National Electrical Supply Jobbers' Association, National Electrical Contractors' Association, as well as that of a number of representative manufacturers. The associations are represented on the Board of Directors by the individuals who were appointed as Committees from their respective associations.

A number of plans have been discussed covering the contemplated work of the Society, and by calling this conference, it is believed that the best thought of the country along advertising, publicity, educational and other co-operative lines will be concentrated on the work.

The program is as follows: Opening Address, by the president, Henry L. Doherty; "Aims of the Society," by the general manager, J. M. Wakeman; "Where the National Electric Light Association Comes In," by Thomas Commerford Martin; "The News Value of Electricity," by Frank H. Gale; "Electricity and the Architect," by Frank E. Wallis; "The Dissemination of News," by Talcott Williams; "Co-operation in the Electrical Industry," by J. Robert Crouse; "An Electrical Advertising Campaign," by William D. McJunkin; "Selling a Commodity," by E. St. Elmo Lewis; "Merchandising Co-operation," by W. E. Robertson; "Efficiency in Local Advertising," by J. C. McQuiston; "Electrical Development and the Electrical Contractors," by Ernest Freeman.

Other papers are being prepared by prominent men in the industry.

It is hoped that from the discussion of the papers, it will be possible to prepare a definite plan for the active work of the Society, which work will be commenced when the full $200,000 has been subscribed. Approximately $100,000 has already been pledged by central stations, manufacturers, contractors, jobbers, the electrical press, etc.

Summer Convention to be Held at Cooperstown.

The Board of Directors of the American Institute of Electrical Engineers held its regular monthly meeting at Institute headquarters on February 14. The Board voted unanimously to hold the annual convention in Cooperstown, N. Y., during the week beginning Monday, June 23, 1913. It also authorized a two-day Institute meeting in Pittsburgh, Pa., during the latter part of April, under the auspices of the Committee on the Use of Electricity in Mines, in co-operation with the Pittsburgh Section. The exact date of the meeting was left to the discretion of the Meetings and Papers Committee, and will be announced later. It was voted to omit the April meeting in New York.

The lectures on radio-activity had previously been announced for Tuesday evenings during the latter part of March and April, but upon recommendation of the Meetings and Papers and Electrophysics Committees the dates were changed to Wednesday evenings, March 19, 26, April 2 and 9.

One hundred and one associates were elected and 80 students were ordered enrolled. One hundred and fifteen associates were transferred to the grade of member and three new members were elected directly to the grade of member. Eighty-two members were transferred to the grade of fellow. The organization of a section was authorized at Spokane, Wash., in response to a petition signed by 25 members and associates residing in that territory.

Examination for Steam Engineer.

The United States Civil Service Commission announces a competitive examination for a first-class steam engineer to be held March 5 at the usual places. The usual entrance salary for this position is $1,200 a year. Graduation from a technical school is not necessary.

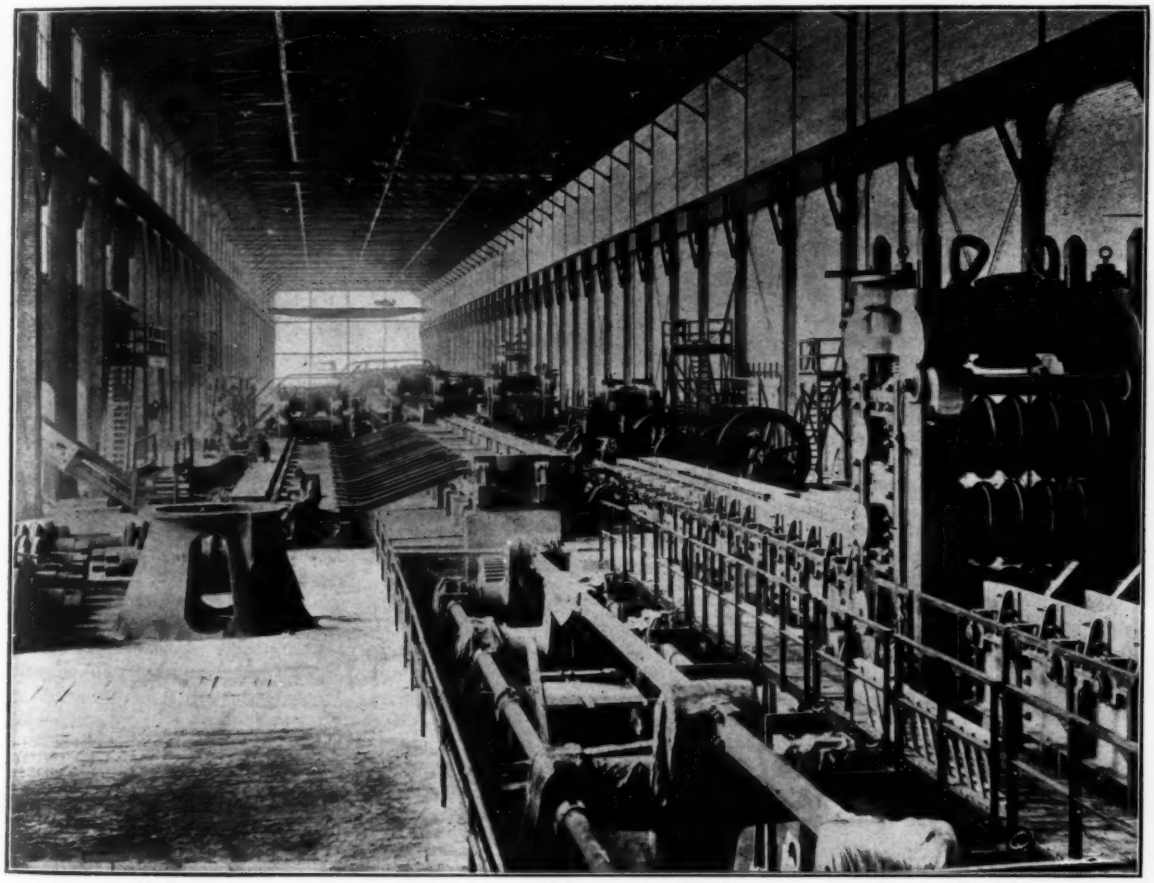
On March 6 examinations will be held for second-class or assistant steam engineer. The usual entrance salary for this position is $1,000.

Electricity in Iron and Steel Mills.

The application of electricity to iron and steel plants, while already reaching large proportions, is destined to open a new era for mill operators. The first and only question regarding the majority of the applications is cheap power, and, as the central stations are doing much to solve this question, it is safe to predict that motor drive will become universally adopted in steel mills, even for the more severe classes of service, such as reversing mills, etc.

The economical production of iron and steel, either in the shape of ingots or manufactured articles, is a matter of national importance. It is, therefore, not strange that the subject of electric drive for steel and iron mills has been given a vast amount of attention.

Motor drive for the auxiliary apparatus of steel mills, including tables, screw downs, cranes, charging machines, etc., has been used for about 20 years. The application of motors to the main rolls, however, is a comparatively new step but one which indicates great possibilities for the future. The popularity of electric drive, while it does not mean that its superiority over steam driving is generally established, certainly shows that there are a great many cases where the motor is found to be preferable.



Finishing End of Motor-Driven Rail Mills.

The comparisons between steam and electrically driven mills should naturally be expressed in dollars and cents but unfortunately there are hardly any specific figures as to the coal consumption of steam-driven mills, while there are available considerable data by which the power consumption of electrically driven mills can be determined with a fair degree of accuracy.

The difficulty of obtaining reliable information about the consumption of steam-driven mills lies in the excessive cost and complexity of the necessary tests. While electric motors do not differ much in efficiency, the coal consumption of steam engines varies in extremely wide limits so that test data obtained on steam driven mills cannot be generalized to the same extent as that obtained on electrically driven mills.

In most cases waste-heat boilers, which are supplemented by slack-fired boilers supply the steam for the rolling-mill engines. The portion raised in the waste-heat boilers is not infrequently said to cost nothing, and a motor, taking the place of the steam engine is expected to have a current consumption costing less than the slack burned under the supplementary boilers. To expect this is very unfair, and the mistake lies in the assumption that steam raised by waste heat does not cost money. The fact is that waste heat must be paid for very heavily, and modern practice shows that it is advantageous to replace the waste-heat re-heating furnace by a regenerative gas furnace, and the steam engine by an electric motor. The latter is true, at least in such cases where properly superheated high-pressure steam cannot conveniently be obtained from efficient boilers or where the connecting-up to an efficient condensing plant is impossible or costly. Coal-fired waste-heat furnaces require about 0.4 ton of good

coal per ton of iron re-heated, and if equipped with high-class boilers it is possible to raise with the waste heat of such furnaces about 1.8 tons of steam at 100 pounds pressure per ton of iron re-heated.

Regenerative reheating furnaces do not produce sufficient waste heat for rolling, but, on the other hand, require only something like 0.16 ton of dross per ton of iron re-heated. Incidentally the very fact that waste-heat boilers must often be supplemented by slack-fired boilers in order to raise the necessary steam for rolling throws a rather curious light on the efficiency of many of the existing steam rolling mills. The input into electrically driven mills, in the great majority of cases, is under 60 kilowatt-hours per ton rolled.

Although owing to lack of data on steam-driven mills, it is not always possible to make a sufficiently close comparison as to the cost of energy, there are other weighty considerations, which, in many instances, have been the deciding factor for the adoption of the electric motor, even in cases when in all probability the cost of electric energy would exceed somewhat the cost of fuel consumption of a steam engine.

The most important of these considerations are (1) the possibility of obtaining an increased output in a restricted space, owing to the compactness and the great overload capacity of the electric motor as compared with a steam engine of the same capacity; (2) low first cost when energy is purchased from a central station, and (3) advantages of central-station power, such as greatly simplified management, decreased cost of attendance, decreased cost of coal and ash handling facilities, increased available space in restricted areas, freedom from stoppages due to boiler and engine repairs, improved light and cleanliness, saving in water, saving in oil, waste and other supplies, and flexibility in arrangment of buildings, departments and machines.

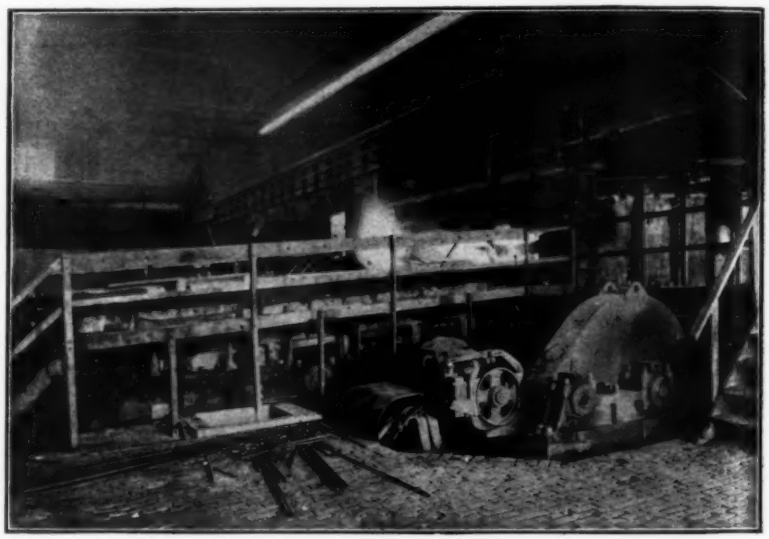
In addition to these advantages, it is known that the economy of the steam engine is very largely dependent on the attention it receives, and in steel works this attention is necessarily reduced to a minimum. The steam consumption may thus be increased by 50 or 100 per cent without detection as the boiler plant generally has to feed more than one mill and the indicating of steam engines driving rolling mills is very seldom carried out for various reasons. On the other hand, the electric motor does not reduce its efficiency as time goes on.

For many years the principal drawback to the complete electrification of steel mills was the lack of confidence on the part of the operators regarding the reliability of electric drives. This has been overcome so far as the small motors are concerned and it is safe to state that at the present time no steel mill would be built without the use of electrically driven auxiliaries.

For driving the main rolls the steam engine had a monopoly until the last few years, and there is no doubt that the improvements which have been made in steam-engine designs to meet the requirements of the rolling mills have been of the greatest value in the development of this type of prime mover generally. The steam engine has certain characteristics which naturally fit in for rolling mill drives, but it also has disadvantages. In case of reversing mills where no flywheel is used the inertia of the moving parts is very small and consequently the rate of acceleration and retardation is usually very high, and it will be generally found that even an average engine can be operated a great deal quicker than the metal can be handled. It is unquestionably true that a steam-driven reversing mill can be operated much quicker than its only rival, the electrically driven mill, but the limiting feature of production is usually not the rate at which the main rolls can be handled but the rate at which the metal to be rolled can be manipulated.

The use of steam engines for driving the main rolls is restricted by the location of the mills, and to reduce the loss in piping the distance must be as small as possible. Everyone familiar with the difficulty of maintaining steam piping tight and properly insulated will appreciate the necessity of reducing the length.

In large plants it has been found necessary to use two or more boiler plants, which naturally increases the first cost, as it means a duplication in equipment and also increased labor and supervision. It is extremely difficult to obtain any reliable figures as to the loss in piping as local conditions affect the results so much as to make the figures obtained useless unless such conditions are considered. In some tests made in a mining plant it was found that the 600 feet of 18-inch piping through which 120,000 pounds of steam, with an initial pressure of 145 pounds per square inch passed per hour, the average temperature drop was from 440 degrees Fahrenheit to 395 degrees Fahrenheit and the pressure drop was about 12 pounds. From the above it will be seen that the steam had a super heat of 76 degrees Fahrenheit. The pipe was insulated and was in what was considered good condition. The above corresponds to a loss of 3,600,000 British thermal units per hour, corresponding to 22 per cent of the available heat in the steam. In another case there was a 12-inch pipe 340 feet long on which the insulation was rather poor, carrying 157,000 pounds of steam in 24 hours. The initial pressure was 120 pounds per square inch, the steam being saturated. The loss through condensation in 24 hours was 22,000 pounds, equal to 14 per cent of the total. Inquiries made from the operators of a number of plants indicate that the average loss in piping is about 15 per cent, although some mills show very much higher figures. From the above it is obvious that in practice the losses are very great and that the steam piping can only be considered a necessary evil and should be reduced as much as possible.



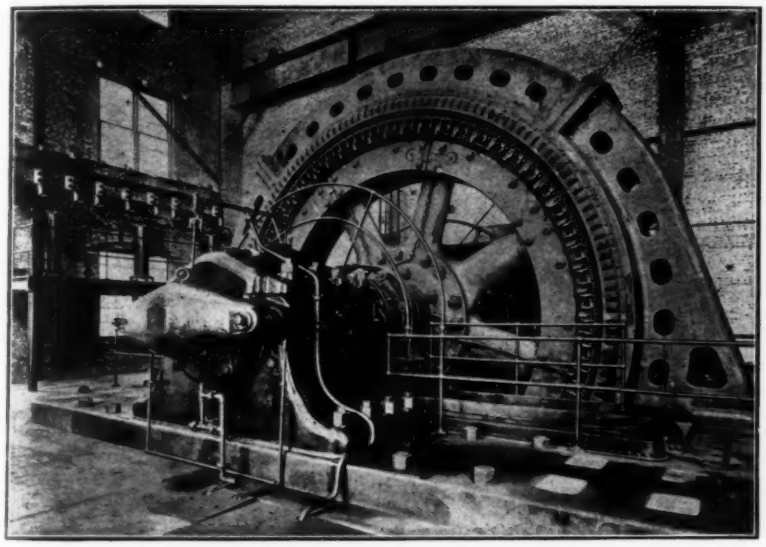
75-Horsepower Motor Driving Feed Table.

These conditions naturally emphasize the advantages of electric drive.

The increasing use of electric motors for driving the main rolls in modern steel works, makes the question of the power requirements of rolling mills of considerable importance. However, it is hardly possible to obtain reliable information from published data, and rolling-

mill practice is wholly based upon knowledge gained by experience. One of the most difficult problems is to determine the set of conditions on which to design the equipment. A great many superintendents are of the opinion that it is impossible to obtain, within limits, an equipment too large. This is a mistaken idea based upon past experience.

The size of the mill as determined by the size of pinions, or the width and diameter of rolls, has comparatively little to do with the size of the motor required for driving it, as the work performed by the same size mill may vary several hundred per cent. The fundamental basis on which the size of motor must be determined is the product of the mill and the tonnage rolled. There are a great



6,000-Horsepower Induction Motor in Steel Mill.

many factors entering into the proposition which must be considered. Dealing first with the product, the following are the principal in their usual order of importance: volume of metal displaced; method of displacement; temperature of metal; class of material; rate of displacement; and size of roll.

The great majority of rolling mills are of the type running continuously in one direction, and to equalize the input to the motor, flywheels are used. It is of the greatest importance to determine the size of flywheel required in conjunction with the characteristics of the motor and control apparatus, as it is only by considering them as a unit that a satisfactory installation can be made. With the ideal flywheel, a motor sufficiently large to carry the average load would be the right size to use, as all the peaks would be taken by the flywheel, and during the intervals between passes energy would be stored in it. In practice it is not possible to use such flywheels, as they would be excessively large, and consequently a compromise must be made between motor and flywheel. It is usual to consider that the mill will run for short periods at its maxmum capacity, that is, with the minimum interval necessary to handle the material, and on this basis the load diagram must be determined. The load diagram can be determined from curves showing the power requirements per cubic inch displaced, in conjunction with the volumes displaced and the rate of rolling. From this diagram, the average load when the mill is rolling at the maximum rate can be determined, and also the size of the flywheel. The average production of the mill must be taken into consideration in determining the size of motor, so as to have an equipment which has suitable characteristics for the normal operating conditions.

In practice it has been found that, although the power required for the individual passes may vary quite appreciably from that caculated, the flywheel will have sufficient capacity to compensate for these individual variations, and that the general operating conditions of the motor can be fairly accurately determined. In practice, it is advisable not to allow for an overload of more than 25 per cent when rolling at the maximum possible rate, so that there is always a certain reserve available in the motor for extraordinary conditions that may arise. Rolling-mill motors are usually designed so that they can carry 25 per cent overload continuously with a 50-degree Centigrade rise and 50 per cent for one hour with a 60-degree Centigrade rise. With motors designed on this basis, it is quite permissible to allow for them being overloaded 25 per cent when the mill is run at its maximum capacity. If the hourly capacity of the mill is considerably less than the maximum that can be rolled, it is then necessary to investigate very closely the conditions existing, so as to determine on what basis the compromise must be made.

Motor drive for the auxiliary apparatus of steel mills has been used for about 20 years. The application of motors to the various machines such as tables, screw-downs, cranes, charging machines, etc., was naturally a very gradual process. The conditions were very unusual, as the work was of an extremely severe nature, requiring frequent starting and stopping, rapid acceleration and sudden stops. Motors had to operate in very hot and dirty places and in a majority of cases gear drive was used. The mills were operated for 24 hours a day, six days a week. The manually operated direct rheostatic controller was the only type available, and this meant heavy overloads during starting and reversing periods.

These several applications require motors ranging from about 5 to 150 horsepower on an intermittent rating basis, with speeds ranging from about 800 to 450 revolutions per minute, respectively.

Motors for industrial purposes were available only in a few types and these were not very suitable for the severe requirements. The best solution of the problem was to modify the types of series-wound motors used for street-railway work, for the sizes above 25 horsepower, and the lighter types of motors were used for the smaller sizes.

On account of the insulation problems in the mills proper, it has become customary to use 220 volts, either alternating or direct current, for all mill motors except the very largest ones. Large roll motors and pump motors are built for 6,600 volts, but it is not generally considered good practice to use 6,600 volts direct on motors of less than 500 horsepower. For use on all constant-speed work, the alternating-current motor is desirable, and for this type of work it is customary to use induction or synchronous motors depending on the special conditions of service.

Whether alternating or direct current should be used on the roll tables, cranes, and other steel-mill auxiliaries is a problem that has been discussed very seriously among steel-mill electrical engineers, and opinions are greatly divided as to which type of motors it is advisable to use. If 220-volt alternating motors are used it is necessary only to use alternating-current transformers to step down the voltage from 6,600 to 240 volts, but these transformers have to be large in kilovolt-ampere capacity, as these auxiliary motors run for a great portion of the time underloaded, giving a poor power-factor for the combined load. If 220-volt direct-current motors are used, it is necessary to use motor-generator sets

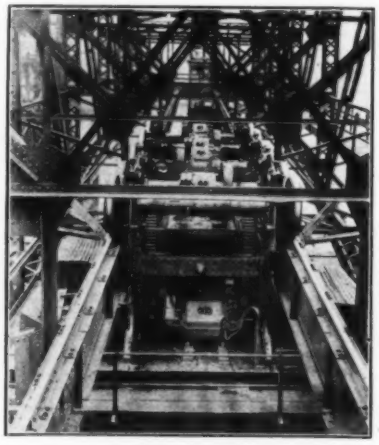
to transform the alternating current into direct current, with a loss of power at this point of about 12 per cent more than in the alternating-current transformers, which have an efficiency of about 98 per cent.

The initial cost of the two systems is about the same, being if anything slightly in favor of the direct-current system. For instance, on a certain contemplated system, the average cost of alternating-current motors and control equipment was found to be $25 per horsepower, while the direct-current motors and control equipment averaged $21 per horsepower, showing a difference of $4 per horsepower in favor of the direct-current equipment. On this auxiliary apparatus there is always a portion of it that is working under light load or not operating at all. As an example, in a blooming mill, certain tables will operate at variou points throughout the mill as the steel goes through, but never all at one time.

On cranes it seldom happens that all the various motions are called into action at one time. As a matter of fact, it is found that this auxiliary apparatus gives a load in kilowatts that is approximately one-quarter of the total rated horsepower of the motors. Motor-generator sets cost about $14 per kilowatt of capacity more than transformers, which figure would be offset by $16 additional cost of the alternating-current motors and control over the cost of the direct-current motors and control, as it is only necessary to have one kilowatt of motor-generator set capacity for each four horsepower of auxiliary motors installed. The main point where the alternating-current motor saves is in the elimination of the commutator, but this is offset to a certain extent by the fact the air gaps in alternating-current motors must of necessity be less than in direct-current motors. An actual comparison of the air gaps in a comparative line of alternating-current and direct-current mill motors shows that the direct-current motor has twice the air gap that the alternating-current motor has on an average.

This results in a big increase in bearing trouble, which offsets to a large extent the saving obtained by the elimination of the commutator. However, the point on which the whole question hinges is the fact that the control of the direct-current motors has been developed better and is simpler than for the alternating-current motors. By the developments of the last year it is possible to use automatic control on all the direct-current auxiliary motors at about the same cost as manual controllers and get a control that is both simple and effective. The saving gained by the use of automatic control, by reducing the number of breakdowns both electrical and mechanical, was the determining fact in causing a certain large mill to continue the use of 220-volt direct-current motors for auxiliary motors in the new developments. These same reasons apply on crane motors, with the additional fact that the use of dynamic braking cannot be obtained in a satisfactory manner if alternating-current motors are used on crane hoists. By the use of dynamic braking hoist controllers and the elimination of the mechanical brake at least one-half of the troubles with cranes are at once done away with.

As an illustration of the advantages of electric drive using central-station power the following brief description may be of interest. This mill manufactures sheet steel of commercial and special sizes and galvanizes sheets by a process producing a high-grade coating. The product is used by the trade for making eave-troughs, spouting, roofing, etc.



Trolley and Hoisting Motors on Ore Bridge.

The main drill has a capacity of from 1,500 to 2,000 tons per month and is driven by a 34 by 60-inch engine operating non-condensing at 75 revolutions per minute, and nominally rated at 2,000 horsepower at 150 pounds boiler pressure. The engine operates the main roll train by the English system of rope drive, the speed reduction being 2.4 to 1. The main roll train originally consisted of several groups of "hot," "roughing" and cold rolls—the latter being used as the last pass or finishing set to give a surface to the sheets, and are usually located at the extremities of the train and provided with a "drag" or brake to absorb lost motion and chatter in the train, which would otherwise have a marked effect on the finished sheet.

The demand for "high polish" on the finished sheet that would pass rigid examination for absence of wrinkles and chatter marks—and which show more clearly in finished products that are enameled, such as automobile bodies and metal furniture—made it necessary to either use a very heavy "drag," (amounting in some cases to 250 horsepower of dead load) or to roll the sheets during the infrequent intervals that the "hot" and "roughing" mills were inactive. The first method was objectionable on account of the wasteful steady friction load, and the latter curtailed production. Various methods have been tried unsuccessfully, and finally electric driving was suggested and its adoption has been fully justified in every respect as regards power consumption, and especially quality of finished product, which is of the highest grade.

The equipment of the mill consists of three stands of 28-inch rolls in a train driven at 33 revolutions per minute by a 16,000-pound sheave, 16 feet in diameter, which is driven by ten 1.25-inch ropes (English system) from 6,000-pound sheave four feet in diameter on the motor shaft which operates at 134 revolutions per minute. The motor is of the wound-secondary type, rated at 200 horsepower and operates at 2,200 volts. A nine-point drum controller is used.

The extra sheave on the motor shaft will be used for driving a similar mill located in the background. The flywheel is 8 feet in diameter and weighs 14,000 pounds. The flywheel and two sheaves are driven through a dental coupling next to the motor shaft bearing.

Cold steel sheets are delivered at the rolls which have been set down hard by the large screws through the stands. Each sheet is passed through from one to three times. Generally, two stands are rolling and one stand grinding, the latter operation consisting of clamping large wooden blocks across the top and bottom rolls, the blocks being moved auxiliary until all surface irregularities are removed. Further polish is then put on the rolls by setting the screw down with a wrench and heavy maul and running with a stream of water flowing over the rolls.

In the "hot" and "roughing" mills a "pack" of from four to eight sheets are put through rolls at once, but in the cold rolls each sheet is passed singly, and the importance of a highly polished surface can be gained from the fact that in handling the sheets must not be allowed to slide on each other, (which would produce scratches) but are turned completely over when removed from the piles to the roll tables. The thickness of the sheets varies from No 11 to No. 30 gauge; No. 18 to 22 being average gauges. The widths are from 24 to 48 inches and the length 60 to 144 inches.

The equipment was designed for 100 tons in 24 hours, and has been operating from nine to fourteen hours per day. The maximum load in the new mill is 66 kilowatts; maximum instantaneous 150 kilowatts; maximum steady 104 kilowatts; the actual demand on a two-minute basis is 90 horsepower. As the sheets require careful and slow handling, and as each sheet takes less than five seconds to pass the rolls, the flywheel absorbs all peaks due to rolling, the peaks being the result of irregular grinding, and are abnormal.

The kilowatt hour consumption for the past seven months:

May	31,900
June	26,700
July	36,700
August	19,800
September	11,400
October	28,600
November	29,500

The contract is on a demand plus an output charge, with discounts for a long term, off peak and primary power. The maximum net bill was $372.00 and the minimum $166.00.

The results obtained with this equipment cannot be obtained with other types of drive, it having been demonstrated that an engine would produce waves or irregularities in the sheets practically coincident with each revolution. The owners are enthusiastic in their approval of the results and have considered dividing the "hot" and "roughing" mills into groups that would use the same motor and sheaves. The load on the hot and roughing mills is more severe, but with properly designed flywheels there is no doubt that satisfactory operation can be obtained. This group system would not be as economical from an operating standpoint as a single large motor which would displace the engine. The rating of the motor would not need to be equal to the engine rating.

In addition to the above, all auxiliary machinery and lighting, amounting to 550 horsepower, are operated at 220 and 110 volt, two-phase, four-wire circuits originally installed and operated by the steel company from its isolated plant. Twenty-two hundred-volt, three-phase current is delivered at the consumers plant and transformed to the voltage used. This business was secured after extended tests of the isolated plant. An incident in connection with the installation was the almost entire destruction of the isolated plant engine about the same hour that the transformers were delivered the actual delay in operating the mill being negligible.

Lighting.

The lighting of steel mills is of the utmost importance and should be given careful consideration in every instance. The following notes taken from a paper by C. E. Clewell are of interest in this connection and offer briefly some of the features to be taken into consideration.

In quite a number of iron and steel plants 220-volt direct-current circuits are exclusively used. This condition is confined in a measure to iron and steel mills and evidently produces certain peculiar limitations in the problem of artificial lighting. For example, large yards must be equipped with lamps supplied from direct-current mains involving a large amount of copper for feeder circuits and relative difficulties in the arrangement of the same.

There are, however, other difficulties imposed by the limitations of supply circuits as in the selection of illuminants. For example, where tungsten lamps are used, they are either of the 220-volt type, or if 110-volt lamps are selected, which is often the case, two lamps must be placed in series across the 220-volt line. Furthermore, all lamps with internal mechanism must fulfill the condition for direct-current 220-volt operation either by a multiple of a multiple-series arrangement.

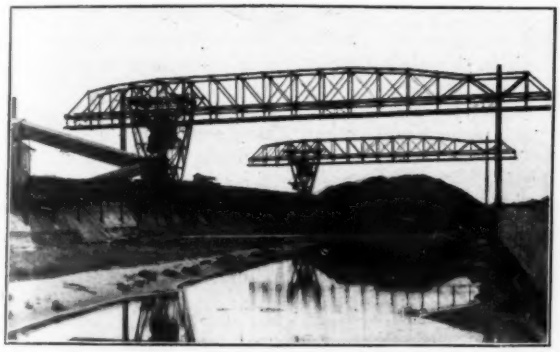
Of course, features other than that of lighting have determined this condition, notably that of the use of the variable-speed motor, which in the past has been largely limited to the direct-current type.

On the other hand, 25-cycle alternating current is today fast becoming standard for steel mills and practically all new mills are installing alternating current and are converting only a part of the power for direct-current use. As stated in the foregoing, direct current has been used almost universally in the past, but owing to the fact that power is now being applied to the main rolls, alternating current offers many advantages.

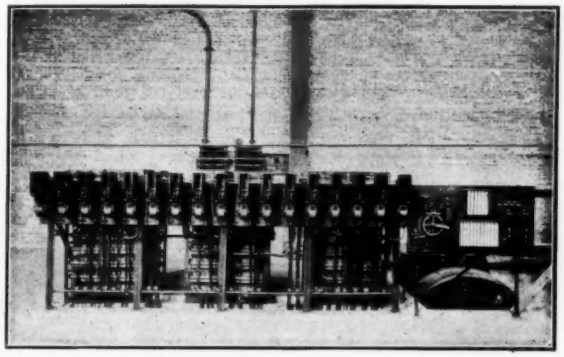
Alternating-current circuits with a frequency of 25 cycles, although not adapted for the operation of all types of lamps on the market, is satisfactory for a number of types.

Observations of existing iron and steel-mill buildings show them in general to consist of large areas with high roof trusses and with unusually dark surroundings. From the illumination standpoint, the very dark surroundings are at the outset a distinct feature and a large problem. The sizes of the areas to be lighted in the majority of the buildings form quite a contrast with the sub-divided sections of the average factory manufacturing spaces, where the surroundings are apt to be somewhat lighter in color, and where the problems of extensive areas do not enter in to so great an extent.

Furthermore, it will be found in a great many cases that these large areas are used throughout for intermittent operations with perhaps a dozen men actively employed in the entire building. This condition exists, for instance, in the typical mills of large areas such as the loading mills where the sheets of metal are loaded by means of cranes on flat cars run directly into the mill; also in flanging departments where boiler heads are flanged in large numbers, but where the number of men employed is very small in proportion to the floor spaces involved. The problem, therefore, becomes one of providing a large volume of light in order to illuminate these areas, and furthermore, to use lamps capable of penetrating the large distances between floor and roof truss



Two Electrically Operated Coal Bridges.



Control Equipment for 6,000-Horsepower Motor.

line, which is often filled with smoke and dust or dirt in suspension.

Most of the buildings may be classed as of the open-girder construction type. That is to say, the lamps must be mounted either from the roof; or must be attached directly to girder or roof truss; or must be suspended from stringer boards or other devices mounted between roof trusses. The crane service which is found in nearly all such buildings, limits the mounting height either to a position directly above the crane or on the sides of buildings between columns.

The difficulty experienced in attempting to outline any specific requirements for iron and steel-mill lighting is due chiefly to the large variety of buildings and to the diversity of work contained therein. Allowing somewhat for the difficulty thus encountered, these requirements, in a general way, are as follows:

(1) Workmen should be able to perform their duties and more around, not only with comparative ease, but with small accident risk as far as it depends on artificial illumination. In many cases this result may be obtained by the use of a low degree of general illumination. It may be here recorded, however, that in general a higher degree of artificial illumination is warranted in most of the buildings than has been the case in the past, or than will possibly be admitted in the near future as economical by many practical iron and steel men. This refers to a sufficient intensity to permit the performance of work at any portion of the floor space without respect to location of the lamps. Obviously, this can be obtained to the best advantage by means of the so-called overhead method of lighting.

(2) Where there is a choice between low and high mounting the lamps should in general be mounted at the higher point in order to avoid the blinding effect, which has of late been given the name of "glare," not only produces eye strain, but reduces the effectiveness of the artificial light, because a man can never see to the best advantage when his vision is intercepted by the bright rays of light from a lamp approximately in the line of vision.

(3) Lighting and motor circuits should be kept entirely separate. This will ordinarily insure reliable illumination, and the operation of the lamps is thus made far superior to those cases where the attempt is made to operate both lamps and motors from the same circuits.

(4) From the nature of the case, numerous instances will be found where the artificial illumination must be sufficient without the use of individual hand lamps. This is due to the nature of the work, which makes impracticable the handling of incandescent lamps by the workmen, but without sufficient light from overhead lamps it is impossible to realize the best results. Thus, in the average foundry it may be an actual handicap for the workmen to be encumbered with extension lines in the performance of their work. It is imperative, therefore, if the conditions are to be such as to promote the highest standard of efficiency under the conditions of natural darkness, that light be furnished from lamps mounted overhead and sufficiently out of the line of vision.

(5) From the engineering standpoint, the kind and size of the lamp should be consistent with the mounting height and also with the class of work under consideration. That is, for high ceilings large lamps should be used, while for low ceilings lamps of relatively small candlepower should be employed.

(6) Extensive yards are generally the scene of active work in the night, as well as in the day, in the transportation of materials. In order to facilitate such work the yard men should be furnished with a low degree of fairly uniform illumination. This in reality is practically the only way to insure the greatest dispatch and the least possibility of accidents.

In the average mills, the major portion of the work is of very large size, and constant attention to crane service in the handling of heavy materials is demanded. As before stated, features of this kind call for the elimination of individual lamps wherever possible, thus requiring general illumination of sufficient quantity and quality to make this elimination possible. For this reason, it is all the more important to consider the various features of the so-called overhead method of lighting in the solution of the illumination problems.

Extended investigations of the relative costs of the overhead lighting method and that scheme whereby part of the light is furnished from lamps mounted overhead, while the remainder is supplied from individual lamps close to the work, show that in a great many cases sufficient illumination can be provided from lamps above the heads of workmen with economy, both as regards first cost and operating expenses. Furthermore, even where there may be a slight increase in the first cost and operating expenses by installing a sufficient number of overhead lamps, the numerous advantages of this method will usually far more than offset the increased expenditure. This statement is further strengthened by the attendant increases in output which result under well lighted manufacturing spaces as compared to other locations which have not been thus provided.

A great deal of valuable work has been accomplished leading to improved lighting conditions in iron and steel mills, but it is believed that during the immediate past but one step has been taken toward a complete solution of the problem. This step has been a partial raising of the standard of lighting facilities. From numerous tests of improved lighting in various mills, it is believed that it is still necessary to take a further step in the matter of even higher standards of illumination intensities before entirely satisfactory conditions will result.

This is apparent from an observance of many large machine shops connected with iron and steel plants which have been equipped with lamps mounted overhead, and which afford very much better lighting facilities than formerly, but which are still provided with inadequate illumination intensities to permit of accurate work without the aid of individual lamps located close to the work. It cannot, therefore, be other than somewhat disappointing, when inspecting improvements which have been made in many plants of this kind, to note that the expenditures have not been accompanied by more than a partial solution of the lighting problem. In numerous cases of this kind the observer is confronted with the opinion by the practical operator that the light is good enough, and in comparison to former conditions, it must be admitted that the facilities are certainly much improved. Adequate illumination does not, however, consist of just enough light to permit a workman to get around the shop, but should actually be sufficient to enable work to be carried on successfully at night as well as in the day time.

As an illustration, tests were made in one large machine shop where the working intensities of light from overhead lamps amounted to scarcely more than one foot-candle, and individual lamps were used almost universally on the machines. In this particular shop the expense for the new installation of lamps was very great. In distinction to this location, other locations are to be found where essentially the same class of work is performed and where the intensities of illumination range from three to five foot-candles from lamps mounted overhead, this quantity of light being just sufficient for the successful performance of work at night or on dark days. It is interesting to note in this connection that measurement

(Continued on page 395)

Iron and Steel Mill Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Bar iron plant having 18 puddling furnaces used in converting pig iron and scrap into blacksmith's bar iron. During normal operation 550 men are employed working in two 12-hour shifts. The monthly output is 3,700 tons, while the capacity of the plant is 4,000 tons.

Total connected horsepower, 93.5. Total number of motors installed, 12. Average kilowatt-hours per month, 3,811.

Kilowatt-hour consumption for 8 months:

Month	Kilowatt-Hours	Tons of Iron	Month	Kilowatt-Hours	Tons of Iron
January	2,520	211	May	4,750	434
February	5,230	888	June	4,230	834
March	2,720	517	July	4,070	641
April	3,770	473	August	4,200	558

The output given above is much below normal.

Load-factor, 7.5 per cent.

Motor Installation.

The following is a list of the motors installed with their respective drives. The supply source is two-phase, 60 cycles, 220 volts.

No.	Horse-Power	Speed R. P. M.	Application.
1	7.5	1,700	Squirrel-cage motor geared to a 20-inch Totten & Company double-blade shear.
2	10	Varying	Slip-ring motors each operating hoist of a mono-rail crane, 300 feet per minute.
2	5	Varying	Slip-ring trolley motors on mono-rail cranes.
2	5	Varying	Slip-ring motors on 52-span bridge-type crane, used with mono-rail cranes.
1	7.5	1,700	Squirrel-cage motor belted to shear cutting three-inch bars.
1	7.5	1,700	Direct-connected to a direct-current generator, 250 volts for operating a 30-inch lifting magnet on one mono-rail crane.
1	30	1,120	Squirrel-cage motor belted to an 80-foot line shaft (12 hangers) driving one 30-inch by 30-inch planer; one 36-inch radial drill; one 14-inch lathe; one 16-inch lathe; one 36-inch heavy-duty lathe; one 8-foot by 5-inch grindstone; and one three-inch bolt cutter.
1	5	1,700	Squirrel-cage motor belted to a 30-inch forge blower, running at 1,600 revolutions per minute.
1	1	1,700	Squirrel-cage motor belted to a Tinius Olsen 100,000-pound testing machine.

Sheet-steel plant manufactures sheetsteel of commercial and special sizes and galvanizes sheets by a process producing a high-grade coating. Product is used for making spouting, roofing, etc. The main mill has a capacity of from 1,500 to 2,000 tons per month.

Total connected horsepower, 500. Total number of motors installed, 6. Average kilowatt-hours per month, 26,370.

Kilowatt-hour consumption for 7 months: May, 31,900; June, 26,700; July, 36,700; August, 19,800; September, 11,400; October, 28,600; November, 29,500.

Load-factor, 9 per cent; operating-time load-factor, 19 per cent.

Motor Installation.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power	Speed R. P. M.	Application.
1	200	134	Wound-secondary motor driving through 10, 1.25-inch ropes three stands of 28-inch rolls, speed 33 revolutions per minute. Motor shaft is equipped with extra sheave which will be used for driving a similar mill.
1	100	825	Belted to shafting driving a 3.25 by 4-inch triplex pump; and one 60-inch cold saw.
1	75	825	Belted to line shafting driving six drills; three straightening presses; and one double emery wheel.
2	50	900	Each belted to Buffalo No. 10 fan.
1	25	1,120	Belted to line shaft driving three engine lathes; one planer; two small drills; one shaper; and one emery wheel.

Iron and Steel Mill Data—Sheet No. 2.

Rail re-rolling mill which buys wornout steel rails and re-rolls them into good rails of smaller section, an average of 800 30-foot rails being re-rolled daily. There are 125 men employed working 12 hours per day. Two hot saws in the plant are driven by a 100-horsepower steam engine.

Total connected horsepower, 1,020. Total number of motors installed, 14. Average kilowatt-hours per month, 158,333.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-Hours.	Month	Kilowatt-Hours.	Month	Kilowatt-Hours.
June	158,800	October	163,100	February	180,400
July	119,800	November	181,100	March	190,400
August	129,900	December	177,000	April	167,600
September	161,300	January	173,100	May	177,500

Load-factor, 28 per cent; operating-time load-factor, 49 per cent.

Motor Installation.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. Motor, except those on cranes are of the squirrel-cage induction type.

No.	Horse-Power-	Speed R. P. M.	Application.
1	100	825	Double-shaft extension, one pully belted to a 60-inch cold saw, the other pulley belted through a 15-foot three-hanger shaft to a Gould 3.25-inch by 4-inch triplex pump, supplying hydraulic pressure for moving tables.
1	75	850	Belted to a 204-foot shaft (25 hangers) driving four Lewis Foundry & Machine Company straightening presses; six Niles four-spindle drills; two Bates straightening presses; one double emery wheel; and one machine for pulling rails on tables.
1	7.5	1,700	Connected by chain to straightening press.
1	7.5	1,700	Belted to straightening press.
1	20	1,120	Belted to a 50-foot shaft (seven hangers) driving two engine lathes; two 14-inch lathes; one saw-grinding machine; one Powell planer; one 16-inch shaper; one hack saw; two small drills; one 18-inch forge blower; and one emery wheel.
1	7.5	840	Slip-ring motor geared to the hoist of a six-ton crane.
1	5	1,120	Slip-ring motor geared to bridge of above.
1	7.5	840	Slip-ring motor geared to hoist of six-ton crane.
1	5	1,120	Slip-ring motor geared to trolley of above.
1	10	1,120	Slip-ring motor geared to bridge of above.
1	50	850	Belted to Buffalo Forge No. 10 steel-plate fan.
1	75	850	Belted to an eight-foot shaft driving one transfer table which takes rails from furnace and transfers them to roll-feeding tables; and one Buffalo Forge No. 11 steel-plate fan.
2	325	160	Driving main mill rolls.

Steel plant, manufacturing sheet-steel tanks. The process consists of rolling the steel, cutting, forming and welding the tanks after which they are enameled and baked. The average daily output is 120 tanks. 30 men are employed working in two shifts of 10 hours each.

Total connected horsepower, 45. Total number of motors installed, 2. Average kilowatt-hours per month, 3,404.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-Hours.	Month	Kilowatt-Hours.	Month	Kilowatt-Hours.
June	3,160	October	2,000	February	4,315
July	2,900	November	2,666	March	5,315
August	3,240	December	5,240	April	3,700
September	2,370	January	4,810	May	4,540

Load-factor, 14 per cent.

The electrical energy consumed for each tank produced is 1.3 kilowatt-hours.

Motor Installation.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 22 volts. Motors are of the squirrel-cage induction type.

No.	Horse-Power	Speed R. P. M.	Application
1	30	1,700	Belted to a five-foot shaft (two hangers) and a 20-foot countershaft (four hangers) driving one Bury 10-inch by 10-inch horizontal air compressor, 80 pounds pressure, supplying air to a size 8, Pangburn sand blast; two 38-feet by 48-feet grinding mills; and one three-inch single-cylinder plunger pump.
1	15	1,120	Belted to a 35-foot shaft (seven hangers) and two two-hanger countershafts driving one G. A. Ohl 7-foot wide sheet-metal press, flywheel 36-inch diameter, rim 7 by 4 inches; one Niagara No. 262 shear, flywheel 20 inch diameter, rim 4 by 2 inches; one Canedy Otto Manufacturing Company No. 15 20-inch drill; one No. 12 double carborundum wheel, 8 by 1 inches; and one Niagara No. 4 punch, driven flywheel 28 inches diameter, rim 4 inches by 2 inches.

of the light directly under the individual lamps in the former location amounted to about five foot-candles, so that the men in both places were working under essentially the same intensity, except that in the former case the region of high intensity of light was limited to a space directly below each individual lamp. In the latter case work may be performed in any portion of the floor space irrespective of lamp locations, because a sufficiently high intensity of illumination is effective over the entire floor space. In the former illustration, whenever the workman changes the position of his work, the individual lamp must be moved to take care of the changed position, involving losses of time and possibly inaccuracies in the work, which are apt greatly to exceed the cost of fully adequate illumination from overhead lamps.

It is furthermore interesting to note that where the overhead lighting method has been employed in many iron and steel mills, the values of illumination intensity for the various classes of work have not been standardized. In passing through a number of different buildings, for example, it will be noticed, upon test, that two essentially similar classes of work will be provided with very appreciably different intensities of light.

For these reasons, it is recommended for careful consideration that while making a study of improved lighting conditions, due regard be paid to bringing values of illumination to some more or less fixed standards for similar classes of work, and it is also advised that practical iron and steel electrical engineers, when working on lighting problems, familiarize themselves with quantitative values of light by means of suitable tests with illumination measuring instruments. A few tests of this kind conducted intelligently will do far more to realize what certain intensities of light amount to than any amount of discussion and mental consideration that can be given.

Commercial Practice
Management, Rates, New Business

Rates.

At a meeting of the New York Companies Section of the National Electric Light Asociation on the evening of February 17 an address was made by John W. Lieb, Jr., on "Rates." During the course of his talk Mr. Lieb exhibited several charts which pointed out interesting analogies between the costs of an electric lighting plant and a railroad. The fact was clearly brought out that the law does not and never has prohibited discriminatory rates. It is only when discriminatory rates become unjust and unreasonable that the law prohibits them. Mr. Lieb explained in detail the system or rates used by the New York Edison Company. There was a large attendance at the meeting.

Soap as an Advertising Medium.

The cleanest way of doing things is the electrical way. With this knowledge in hand, the logical device for the central-station advertiser to seek in the way of an exploitive novelty is an aid to cleanliness, and that is just what A. T. Macdonald, sales manager of the Louisville Lighting Company, of Louisville, Ky., is doing.

The company has placed an order for a large number of small bars of soap, each to be duly inscribed with an appropriate phrase pointing out the desirability of electrical cleanliness in all things. The soap itself will be better than the usual article put up for advertising purposes, and every provision is to be made to insure the legibility of the "copy" as long as the lubricator lasts. Distributing the novelty to hundreds of householders, hundreds of office men, the hotels, department stores and other popular centers, the Louisville Lighting Company hopes to win the approbation of many persons, incidentally calling their attention to the work of the big central-station and its functions. It is a safe bet that the people who use soap most frequently are those who most deeply appreciate the advantages of electric light, heat and power, and therefore the unusual medium chanced upon by Mr. Macdonald seems to be an excellent one.

Paducah Company to Co-operate in Celebration.

The Paducah Light & Power Company, Paduach, Ky., will take a prominent part in "Home-Coming Week," to be celebrated during the seven days following May 20 in the prosperous Western Kentucky city. The company has announced, through Manager W. L. Weston, that it will provide, free of charge, all necessary ornamental illumination during the festivity, stringing thousands of incandescents about Paducah's principal streets. The public-service company has played a very prominent part of the development of the McCracken county seat to a point where it will scarcely be recognized by native Paducahs who left home years ago to seek their fortunes and who will return during Home-Coming Week with success achieved.

The company will co-operate with a citizens' committee appointed to work out the details of the decorations.

ELECTRICALLY DRIVEN VENEER MILL.

By A. S. Witmer.

On account of the large amount of waste wood and the comparatively heavy demand for steam used in steaming logs and operating dry kilns, a veneer mill would ordinarily be classed among the less likely prospects by power salesmen. A careful analysis of all the conditions of operation, however, may reveal some advantages obtainable through central-station service which will, even under these circumstances, show a net balance in favor of outside power service.

The Louisville Veneer Mills, of Louisville, Ky., an enterprising firm of veneer and panel-board manufacturers, discarded an old steam-engine plant in July, 1912, and equipped its mill throughout with induction motors, buying energy from the central-station company.

The service was adopted and investment made after lengthy consideration, and then with some skepticism as to the probable outcome. The results, however, are in line with calculation and estimates made and are gratifying to the management.

The main factory is a four-story building. The machinery of the plant occupied three floors, and in the basement was formerly a mass of shafting, belts, pulleys and one rope driver. The top floor is used as a store room. Business is not restricted to the making of veneer only, but panel boards and all

lines of veneered wood are manufactured, cut to size and sanded for the furniture factory or other market. Consequently, this plant contains a very general line of woodworking machinery.

The mill was formerly driven by a 14.25 by 4 by 24-inch Buckeye engine, running at about 130 revolutions per minute, and several small hoisting engines. Indicator card showed the friction load to be over 60 per cent of the average running load, and over 50 per cent of the maximum. Here was plainly a chance for a big saving to be made by individual motor drive and the same conditions no doubt are general in woodworking plants. As in all such plants, there was available, and of course, necessary to dispose of, a vast amount of waste wood. This included slab wood, veneers, sawdust and shavings, trimmings, etc. A market for the courser wood was found among the bakeries, it being especially desirable for baking ovens on account of the fact that it is mostly hard wood. It appears from results obtained that the revenue received from the sale of this wood is considerably in excess of its value as fuel when used under the boilers. The non-marketable portion of the offal is used for producing steam for steaming logs, for kilns and glue kettles. Though steam is required continuously, very little coal is used, this portion of the offal of the mill accumulates sufficiently during the day to take care of the night demand under ordinary conditions. Pressure is kept at about 60 pounds to take care of a fire pump.

The principal motors installed are those driving the rotary veneer cutters, veneer saws, band mill and veneer slicer.

Two 30-horsepower motors running at 1,140 revolutions per minute, drive two circular veneer saws, one of which is 60 inches in diameter, the other 72 inches. Motors are belted direct to saw mandrels, both of which run at 700 revolutions per minute. The 72-inch saw is shown in Fig. 1. Motor is located below the floor. Carriage is driven from mandrel shaft by belt. A test on motor driving this saw showed a heavy starting load. A squirrel-cage motor with high-resistance rotor is used and the starting current showed 600 per cent of normal full-load current with the compensator connected to the 85 per cent tap, motor coming up to speed in 30 seconds. On account of the large total motor load in the plant and the proportionally large transformer capacity, this heavy starting current is not objectionable. Under other conditions another type motor would probably be preferable. This motor developed 6.8 horsepower while driving saw light; while cutting 9-inch oak one-sixteenth inch thick, 20.4 horsepower; 15-inch oak, 23.4 to 27.3 horsepower, according to speed of feed, this being manually controlled. With carriage returning, 13.6 horsepower.

Fig. 1.—Motor-Driven 72-inch Circular Saw.

Fig. 2.—35-Horsepower Motor Driving 100-inch Veneer Cutter.

These values for horsepower are taken from the input, assuming a 15-per cent motor efficiency and allowing for this. These will be so used throughout this article.

Fig. 2 shows a 100-inch Coe rotary veneer cutter. A 35-horsepower, 1,140-revolution-per-minute motor drives the machine, turning the log against the knife, and also operating the feed while cutting. This motor drives through a Morse silent chain and friction-clutch pulley. An auxiliary 5-horsepower motor is used to drive feeds while placing logs in position.

A test on this motor with a 6-foot gum log in machine, 38 inches in diameter, showed the following: Power developed in running motor and pulley 2.41 horsepower; turning log without cutting, 5.35 horsepower; cutting one-eighth-inch veneer, a maximum of 25 horsepower, as the knife hit the high spots in the log. As the log became perfectly round, at about 33 inches diameter, the power decreased to 20.8 horsepower; at 30 inches, 16 horsepower, and at 24 inches, 13.7 horsepower. The decrease in power required is due to decrease in peripheral speed and the gradual clearing of knots as the log decreases in diameter. No other lengths were tried, but it is very probable that the power required would be very nearly proportional to the length of the log.

An 88-inch cutter of the same type was equipped in the same manner. Results obtained on these machines are entirely satisfactory.

A Tinker-Davis 6-foot band-saw mill with 7-inch blade is operated by a 40-horsepower squirrel-cage motor by belt. This motor takes from six to eight times full-load current on starting. It comes up to speed in about 40 seconds. The carriage is driven separately by a 10-horsepower motor. This feed is controlled manually and it is therefore difficult to obtain uniform watt-meter readings. A 24-inch log cut through the center showed a load varying from 21 to 54 horsepower. The high value represents, however, only a swing of the needle. On some of the smaller cuts maximum value went to 59 horsepower. The average load, while making a 24-inch cut, was about 30 horsepower, and on a 4-inch cut about 22 horsepower. Running saw light required 14 horsepower. The power required to operate carriage during an average cut is 3 horsepower. On return of carriage, which is at a much higher speed, 8.5 horsepower is required. A 7.5-horsepower motor would be sufficiently large for this work.

A 12-foot veneer slicer is driven by a 20-horsepower 850-revolutions-per-minute motor belted to shaft, which is geared to machine. The knife in this

machine is stationary and horizontal, and the log is held in a slanting position and carried up and down as the cuts are taken. Running machine without log caused the watt-meter needle to swing from zero to a value representing 21 horsepower in exact time with the movement of the machine. With the log in the machine the same conditions obtained, except that the needle on the downward stroke did not swing back to zero, the cut being taken on the downward stroke. While cutting one-eighth inch poplar 24 inches wide and 10 feet long, the values obtained were 17 horsepower to 22 horsepower on the first cuts, and this gradually increased to nearly an even load of 22 horsepower.

There is another installation, which may be of some interest, shown in Fig. 3. It is a 20-horsepower 850-revolutions-per-minute motor of slip-ring type, with shaft extended on both sides located close to ceiling and driving a 42-inch 3-drum J. A. Fay & Company's sander on floor above. This motor has given some trouble at times, probably on account of being overloaded. On test, while sanding three-ply oak 0.25-inch thick and 28 inches wide fed on a slant making probably a 33-inch width, the load varied from 18 to 24 horsepower. It appears, therefore, that when still wider panels are worked the load may at times go to 30 horsepower. Running sander light this motor delivered 9.1 horsepower.

The balance of the installation consists of motors varying from 3 to 15 horsepower, driving machines such as are in general use in woodworking plants. Fig. 4 shows the results and very desirable conditions which can be obtained where all belts and shafting are eliminated.

A number of machines, such as double saws, joiners and planers, are operated in a manner similar to that of the sander shown in Fig. 3, the regular machine shaft being replaced by the motor with its extended shaft and hangers. The standard 850-revolutions-per-minute motor is used in these cases, and excellent results are obtained.

A total of 35 motors are in use, aggregating 396 horsepower. Three-phase 440-volt current is used from two 150 kilowatt-ampere transformers. The plant operates regularly ten hours a day. Current consumption since the change to electric drive has been made is as follows:

Month.	Kilowatt-Hours.
July	5,300
August	13,800
September	17,393
October	13,581
November	12,200
December	14,700
January	12,600

Not taking into account the month of July, the average 24-hour load-factor based on the installation, has been 6.6 per cent, or based on running time, 19 per cent. This is probably a fair example of the average woodworking establishment of medium size.

Summarizing the conditions which led to the change from steam to electric drive in this plant, the main item was undoubtedly the elimination of an enormous friction load. The fact that there is a market for a good share of the offal and that some steam is required by the generation of which such offal, as is unmarketable, can be disposed of and accumulation avoided was favorable. An old engine was in operation which was giving some trouble, and several small engines to which steam was piped through considerable distance. One man's time was saved. The upkeep on belts and other transmission apparatus was big, and this has been practically all cut out. These facts, together with a favorable power rate, made a good customer for the central-station, and results so far have been very satisfactory to both parties.

Textile Mills Using Central-Station Service in Louisville.

Illustrating the careful study which is given the power proposition by manufacturers these days, the Louisville Cotton Mills Co., of Louisville, Ky., operating one of the largest spinning mills in that part of the country, has just completed an investigation of the subject covering several months. In addition to securing a report from disinterested engineers of wide experience, the company had the advantage of painstaking tests made by the General Electric Company. Though the final decision was that the investment already made in steam-producing equipment and transmission machinery was so great that it could not economically be thrown out in favor of the electric drive at the present time, the company has determined nevertheless to operate certain departments electrically. These are the picker-room, the dye house and the waste mill.

The Puritan Cordage Mills, another Louisville concern in the textile field, is a large user of electric power, and receives its current from the Louisville Lighting Company. It has a 225-horsepower plant. Charles T. Wolfe, president of the company, is enthusiastic over the merits of the installation, details of which indicate that the picker-room machinery is operated by one 35-horsepower motor; card and spinning room by two motors of 35-horsepower each, and the finishing room, containing sash-cord braiders, cotton-rope machinery and clothes-line braiders, by several motors ranging from 10 to 25 horsepower. The group system is generally used. Mr. Wolfe, in commenting on the situation, featured the relief that comes to the manufacturer who does not need to worry about making power and keeping that department going.

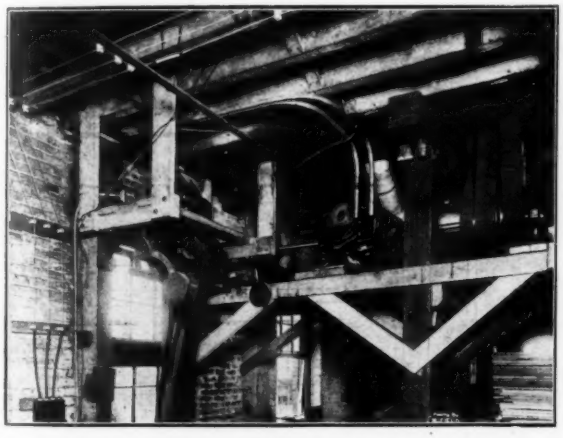


Fig. 3.—20-Horsepower Motor Driving Three-drum Sander.

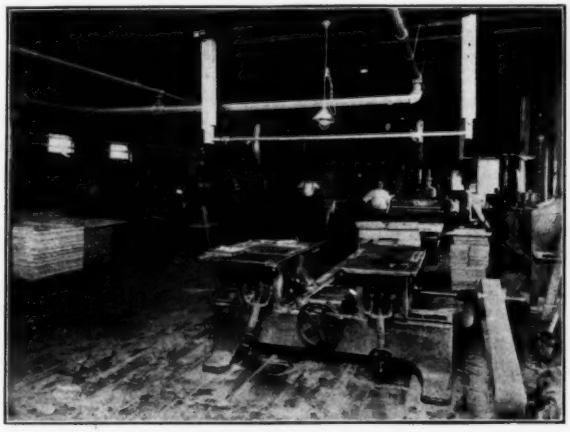


Fig. 4.—Group of Motor-Driven Machines. Shafting Eliminated.

Electrical Construction

ELECTRICAL EQUIPMENT OF THE JERSEY CITY POST-OFFICE.

By Harold L. Alt.

Many of the readers of this magazine will doubtless be interested in a detailed description of the electrical installation as it is planned to go into the new Post Office at Jersey City, N. J. Not, perhaps, that there are any great or startling novelties contemplated, but simply as an example of what the government experts consider as good, substantial and permanent electrical work.

The post-office building was designed complete in the Supervising Architect's Office, in Washington, the electrical-wiring plans being laid out there. Details such as fixtures, boxes, and other small apparatus have been more or less standardized by the government in all post-office work, so that the details presented here are largely typical of post-office electrical work throughout the entire country. No attempt has been made to provide current on the premises; all power is supplied by a public service company which supplies a large portion of all the gas and electric current consumed in Jersey City. Therefore, as far as this article is concerned, we are limited to the method of wiring the structure, the materials utilized, and the fixtures installed.

The basement plan given in Fig. 1 shows the main conduit for electric lighting brought in underground from a near-by pole and run to the switchboard from which feeder conduits are extended to the various distributing panels, several of which are located on the first-floor plan shown in Fig. 2. The power conduit follows a similar course with feeders run from the switchboard to the points required. The pole from which the service lines are brought into the building is 30 feet long, and is made up of three pieces of extra heavy iron pipe eight inches, 7 inches and 6 inches respectively, in diameter, and is set in concrete.

The telephone service is brought in un-

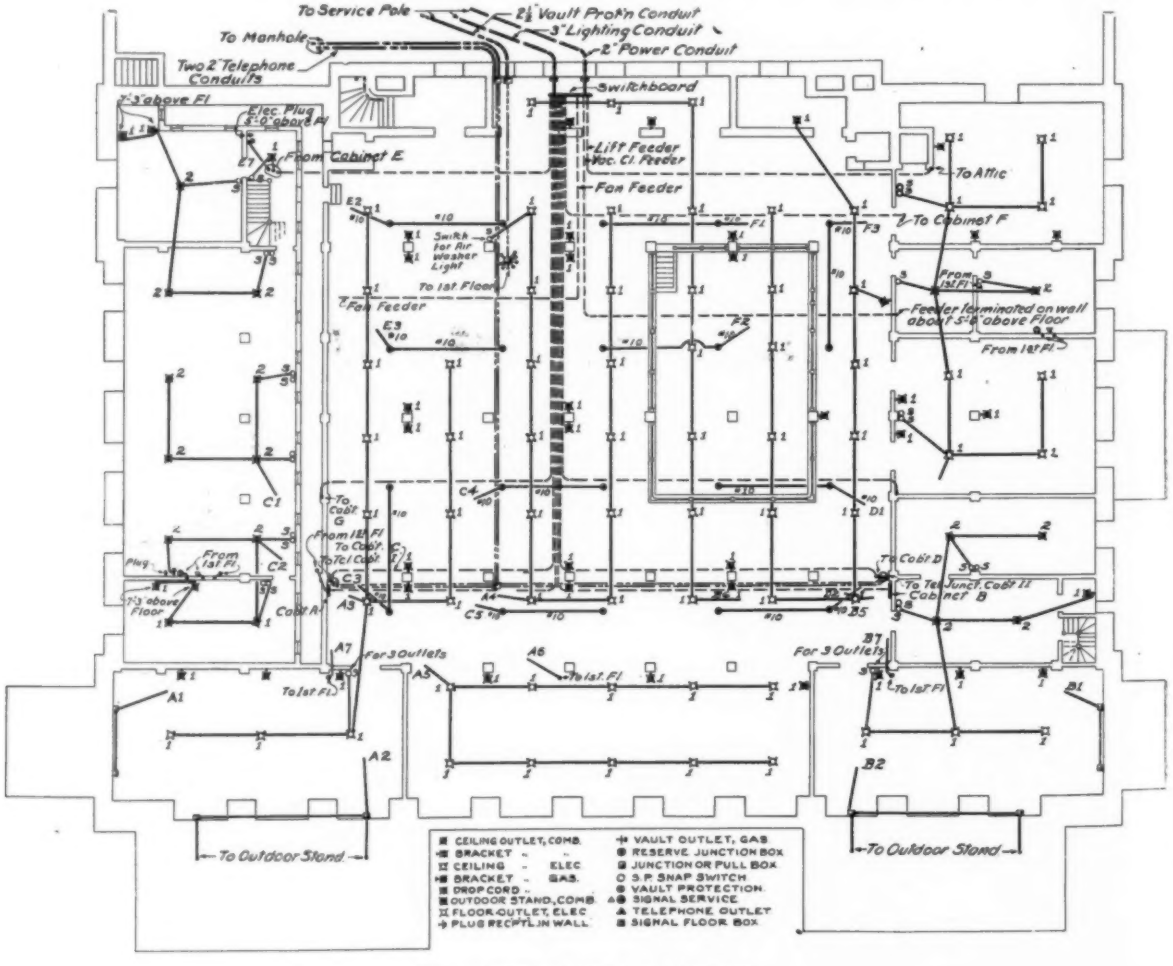


Fig. 1.—Plan of Circuits in Basement.

derground from a special manhole outside of the building. This manhole is of brick laid in cement mortar coated both inside and out with one-half-inch cement mortar and is set on an 8-inch concrete foundation. The cover is of cast iron set flush with the finished grade.

The conduits are best quality steel tubing of standard pipe size, covered with a preparation to prevent oxidation, and those which are laid underground are painted on the outside with asphaltum. In running the conduits long bends were used and no more than the equivalent of four quarter bends were installed in any run between the terminals at the cabinets and the outlets, and junction or pull boxes. The radius for the inner curve of one-half-inch conduits was not notched into the tops of the joists not to exceed a depth of one and a half inches and at a point within 24 inches of the joist support.

At each electric or combination outlet a steel outlet box of one-sixteenth-inch metal is placed, arranged so that the gas pipe (if there is any) projects from the center of the box, or (if there is no gas pipe) with a one-half-inch fixture stud. The outlet boxes for ceiling use are of circular shape, shallow type, about four inches in diameter and without covers; those for bracket use on the side walls are about four inches square, having covers with circular openings arranged for four-inch canopies.

The junction and pull boxes are similar to the bracket outlet boxes, except on the main service conduits for lighting, vault being of the lock-and-key design. They are in no case connected to the neutral side of the line, and, in general, each snap switch controls one ceiling outlet only.

The plug receptacles are set in boxes similar to those used for the snap switches if in the wall, or in boxes similar to the floor outlets, if set in the floor. They are of the flush type with rectangular nickel-plated face plates for all wall locations.

For all lighting and telephone floor outlets metal boxes are used with adjustable covers and brass floor plates fastened to the covers with tap screws as shown in Fig. 6. These boxes are all set below the floor level so that the tops of the brass plates come level with the finish floor.

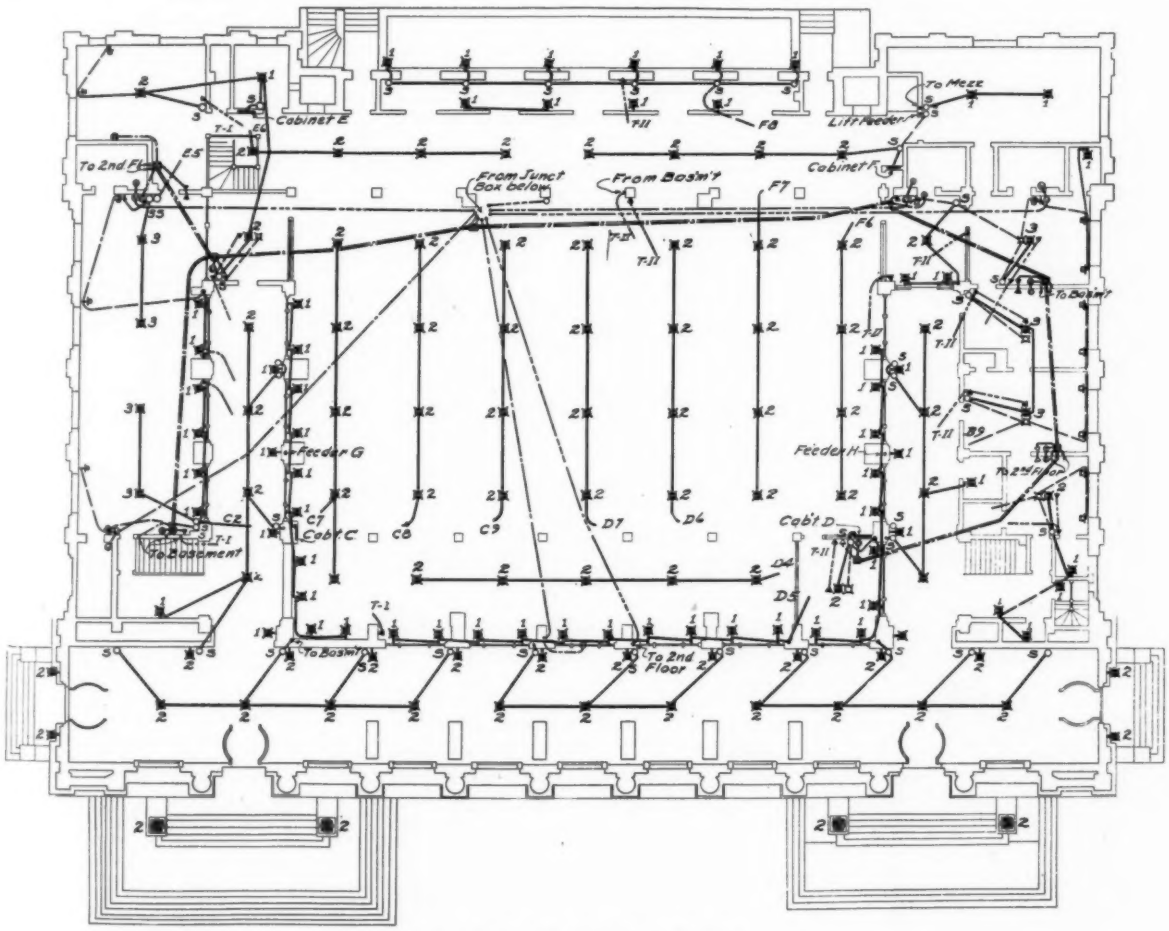


Fig. 2.—Plan of First-Floor Circuits.

reduced to less than three and one-half inches, while three-inch conduits were installed with minimum radii of 11 inches, and other sizes proportionately.

The conduit runs are continuous from outlet to outlet and joints are made watertight by the use of white lead. Cross runs in partitions were avoided as far as possible, and where running in wooden construction the conduits are protection, etc., where they are six inches square and three inches deep.

Where snap switches are installed they are set about four feet above the floor in metal boxes with the front edge of the cover flush with the finished wall line. They are 10-ampere, single-pole switches, including both rotary and push-button types, with nickel-plated face plates, those located in public corridors

The cabinets for the distributing panels for the lighting system have their bottoms placed at a height of about four feet above the floor, with steel sides and backs framed together with riveted angles and corner irons. The cabinets located in the finished portions of the building are securely fastened and set in the wall with the front edge flush with the finished plaster or wainscot line, and have neat oak trim

secured to the iron at the corners of the cabinets. In this trim an oak-frame door with a heavy, beveled plate-glass panel, knob and flush lock is hung. The inside of the trim and door frame is lined with one-sixteenth-inch sheet steel, which is separated from the glass by a sheet of felt or rubber. The finish of the woodwork is made to match that of the building at each individual location.

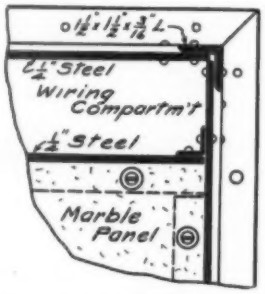


Fig. 3.—Front View of Corner of Cabinet With Door Removed.

A detail of the main switch cabinet and tablets in shown in Fig. 5.

In the cabinets are set tablets of highly polished Vermont marble, on which the busbars, switches and fuse studs are placed. The tablets are made up of a seven-eighths panel with seven-eighths-inch sides framed together with angle and corner irons. The panel and corner irons are secured to the angle irons at the back, which are riveted to the sides of the cabinets so as to be perfectly rigid.

The busbars used on these panels are of rectangular cross-section, the main bars being on the back of the panels and the branch bars on the face.

The bars, lugs, clips, switch blades, etc., are, in general, of copper of the highest conductivity, milled to the proper shape and are of such size that the current density at the maximum load does not exceed 800 amperes per square inch of cross section, the main busbars on the distribution panels being calculated at 10

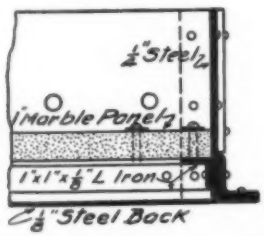


Fig. 4.—Sectional Plan of Part of Cabinet.

amperes per branch circuit. The contact area on the blades of the knife switches is limited to a minimum of one square inch for every 50 amperes of current and the feeder switches are of the single-break, knife type. The switches on the distribution panels are 25-ampere double-pole, single-break, single-blade, knife pattern.

Each branch circuit is indicated on the tablets by a number plate between the fuses. These plates are made of fiber, fastened to the panel with dowel pins, and have the number stamped thereon and filled with white paint. The numbers are arranged to commence at the bottom of the tablet and to run upward, with the odd numbers on the left and the even on the right.

For each distribution tablet a directory is furnished consisting of white Bristol board on which is a typewritten list of the circuits controlled by that tablet. This schedule is secured to the interior of the door by a brass card holder in such a position as to be invisible from the exterior.

The lighting feeders which are run in from the pole consist of three conductors, the neutral having a cross-section equal to the combined areas of the two outside conductors, while the power wires consist of two conductors only. The branch circuits are two-wire, both conductors being run in the same conduit.

The conductors are double-braided, rubber-covered, well tinned, soft-drawn copper of the highest conductivity, complying with the latest specifications of the National Electrical Code. No splices or joints are made in the conductors except at the outlets where solder and three layers of rubber and two of friction tape are employed. No conductors were drawn into the conduits until after the plaster was dry and the conduits free from moisture.

The outlet in the vault has the junction box set exposed on the wall and at practically the same height as the plug receptacle outside. This junction box is provided with a bushed opening through which a flexible cord of No. 16 re-inforced silk-covered wire is passed to the plug.

The switchboard is set in position 3 feet 6 inches from the wall, and is composed of panels of the same quality of marble used for the tablets but one and a half inches thick, polished face, and half-inch bevel. The switches and fuses are mounted on the face of the board and the busbars and connections on the rear. The lighting switches on the board are of the triple-pole, single-break knife pattern, while the power switches are similar, but double-pole. All metal work on the face of the board is of copper finish, polished and lacquered, and the iron and grill work is painted with two coats of dead black. The feeder conduits terminate back of the board within four inches of its top, and are secured in position by a rack. There are two watt-hour meters on the switchboard, the one for power being of the two-wire type with a capacity of 80 amperes and designed for 500 volts direct current, while the lighting meter is a single-phase, 60-cycle, three-wire instrument with a capacity of 200 amperes (each outside wire) and designed for 100-220 volts alternating current. The meters are in-

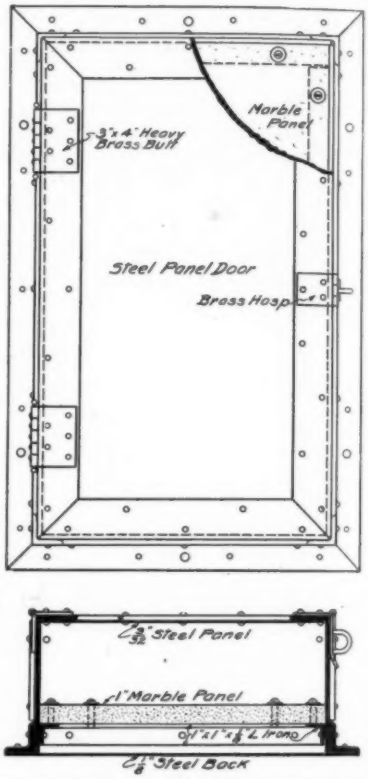


Fig. 5.—Front View and Section of Cabinet.

closed in glass cases and are mounted on the front of the board, with the connections on the rear. The grill work used in connection with the switchboard is constructed of No. 9 B. W. G. iron wire laid in one 1.5-inch diamond mesh, in a one-inch channel frame, the ends of the wire being through channel and headed. At each end of the board is placed a grill door three feet six inch-

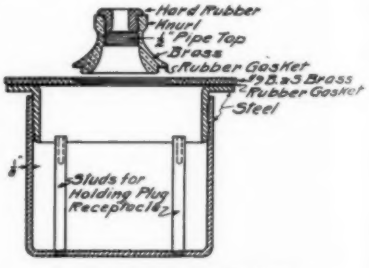


Fig. 6.—Floor Outlet Box.

es wide and six feet high, securely attached to the wall by means of strong brass hinges and equipped with a spring lock. A recording voltmeter is connected in circuit with a voltmeter switch so arranged that the meter can be connected between the outside wires or be-

tween the neutral and either of the outside wires. This voltmeter is designed for operating 110-220-volt, 60-cycle, alternating current, 24-hour period, with eight-inch charts. The pilot-lamp bracket has a porcelain-lined half shade and an Edison-base key socket connected to a double-pole fuse block mounted on the back of the board and connected to the busbars.

The fixtures installed in this building are according to the various government standards. All the exposed parts of the fixtures are in general made of brass of a composition approximately one part zinc and two parts copper.

The fixture wiring is of the National Electrical Code standard fixture wire, the sizes of the wire being sufficient to supply 0.5 ampere for each socket to which the wire is connected, down to No. 16 B. & S. gauge. All sockets are wired in multiple and the wiring is all concealed within the fixture construction except in the cases of chain stems. The exposed wiring of chain-supported fixtures has a silk outer braid of a color matching the fixture, the wire being woven into the chain in the most inconspicuous manner possible. Pendent push switches—single-pole, single-point, five-ampere, 125 volts, National Electrical Code standard—are provided for all pendent fixtures in the postoffice work room. An insulated bushing is provided at the bottom of the fixture shell for the switch-cord connection. the cord being long enough to bring the switch within six feet six inches of the floor, and being composed of No. 16 B. & S. gauge, silk-covered, re-inforced, lamp cord. The fixture sockets are of the keyless type for all pendent fixtures and chain pull sockets on the brackets.

Annual Meeting of Electrical Committee.

The next annual meeting of the Electrical Committee of the National Fire Protection Association will be held in New York March 26 and 27. The object of this meeting of the committee, of which Ralph Sweetland, 141 Milk Street, Boston, Mass., is the secretary, is to consider proposed changes in the National Electrical Code. Reports of sub-committees on matters referred to them at the last meeting will be gone into, and those changes in the Code which they suggest which the Electrical Committee as a whole decides to be desirable will be submitted to the National Fire Protection Association at its next annual meeting for final action. Some of the more important of the changes to be considered are given below.

Committee on Rule 1d.

"For two-wire direct-current generators, single pole protection will be considered as satisfying the above rule, provided the safety device is so located and connected that the means for opening same is actuated by the entire generator current, and the action thereof will completely open the generator circuit.

"If a generator, not electrically driven, in a two-wire system has one terminal grounded, the safety device above mentioned must be placed in the grounded lead.

"For three-wire direct-current generators, compound or shunt wound, a safety device must be placed in each armature lead, and so connected as to receive the entire current from the armature. Fuses will not be acceptable. The safety device must consist of either: (1) a double-pole, double-coil, overload circuit-breaker, or (2) a four-pole circuit-breaker connected in the main and equalizer leads, and tripped by means of two overload devices, one in each armature lead.

"The safety devices above required must be so interlocked that no one pole can be opened without simultaneously disconnecting both sides of the armature from the system."

Committee on Rule 2b.

Introduce under a new heading, "Switchboard," a new section, reading as follows:

"Rule 23z. Where spacings of conductors on and in connection with switchboards cannot be maintained, they must be surrounded with a tight non-combustible outer covering."

Block Distribution.

Rule 12c. — Add new sentence, "No overhead service to a building shall supply more than one building, except by permission from the Inspection Department having jurisdiction."

Rule 17d.—Change to read, "No underground service from a subway to a building *and no service from a private generating plant* shall supply more than one building except by permission from the Inspection Department having jurisdiction."

Committee on Rule 15.

Section a, amend to read: "The neutral wire must be grounded and the following rules must be complied with."

Paragraphs 1, 2 and 3, no change.

Fine print notes under *Section a,* strike out.

Section b, amend to read: "Transformer secondaries of distributing systems must be grounded, provided the maximum difference of potential between the grounded point and any other point in the circuit does not exceed 150 volts and may be grounded when the maximum difference of potential between the grounded point and any other point in the circuit exceeds 150 volts. In either case the following rules must be complied with."

Paragraph 2, amend to read: "When no neutral point of wire is accessible, one side of the secondary circuit must be grounded."

Fine-print note, strike out.

Section g, and fine-print note under same as at present, but add the following fine-print note: "Companies and departments in charge of water works are urged to allow the attaching of ground wires to their piping systems in full confidence that the integrity of such piping systems will not in any way be affected whatever may be the normal voltage."

The above amendments to Rule 15 were considered at the meeting of the Electrical Committee held in Boston March 27, 1912, and it was voted that they be presented at the 1913 open meeting for the purpose of having them adopted and printed in the Code.

The following suggestions have been received by the chairman, too late to be presented to the Committee for consideration: (1) It is suggested that it should be made clear that ground wires should not be attached to water or gas pipes which have cement joints, but only be made to complete metallic pipe systems. This might be accomplished by adding a fine-print note to *Section g,* covering the above idea. (2) It is suggested that in *Section b,* private plants, where the primary voltage does not exceed 550 volts, should be excepted from the grounding requirement, that is, that *Section b* should read:

"Transformer secondaries of distributing systems (except private plants where the primary voltage does not exceed 550 volts) must be grounded, provided maximum difference of potential between the grounded point and any other point in the circuit does not exceed 150 volts, and may be grounded when the maximum difference of potential between the grounded point and any other point in the circuit exceeds 150 volts. In either case, the following rules must be complied with."

Committee on Rule 23d.

Rule 23d. Amend first paragraph to read:

"Must be so placed that no set of small motors, small heating devices or incandescent lamps whether grouped on one fixture or on several fixtures or pendants (nor more than 660 watts), will be dependent upon one cutout. Where wiring equal in size and insulation to No. 14 B. & S. gauge, approved rubber-covered wire is carried direct into keyless sockets, the circuits may be so arranged that not more than 1,320 watts (or thirty-two sockets or receptacles) will be dependent upon the final cutout; provided, however, that the location of sockets and receptacles is such as to render unlikely the attachment of flexible cord thereto. Except for signs and outline lighting, sockets and receptacles will be rated at not less than 40 watts each."

Omit first sentence and also words in brackets in second paragraph.

This will leave paragraphs beginning "All branches or taps" and "On open work in large mills" to remain as they are at present.

Theater and Moving-Picture Establishment Wiring.

Rule 26. Amend second paragraph by prefixing the following: "Except in the case of stage pocket and border circuits," also cut out the words "of the inspection department having jurisdiction," so that the paragraph will read: "Except in the case of stage pocket and border circuits, the same conduits must not contain more than four two-wire or three-wire circuits, except by special permission, and must never contain circuits of different systems."

Rule 38d and *e.* Change in each instance "24 receptacles" to "26 receptacles."

Rule 38. Change the first two lines to read: "Must be of approved type insulated from ground, and controlled," etc.

Rule 38t. First paragraph. Add a sentence reading as follows: "Where receptacles are used they must be inclosed in approved boxes."

Rule 38u. To paragraph 2 add the following sentence: "Rheostat and any substitute therefor must be considered as a

part of the moving picture machine and their location be subject to approval thereby."

Rule 38. Change the heading of section *u* to read: "Moving Picture Equipments other than those of approved miniature type."

Sections 1, 2, 3, 4, 5, 6, 7 and 8 to follow as amended.

Add a new section to read: "*v.* Moving-picture equipments of approved miniature type for home, lecture and similar purposes.

"1. Arc lamp used as a part of machine must be constructed so far as practicable similar to arc lamps of theatres, and must not require more than 350 watts to operate same.

"2. The rheostat or other current controlling device must conform to the requirements for similar devices for theatre work, and must be attached to and form a part of the machine.

"3. Films must be of the non-inflammable type and must not be more than 100 feet in length and one inch in width.

"4. Where the use of an approved booth is dispensed with, a mat made of asbestos or other approved material must be placed under machine when in operation; this mat to be of such size and so arranged that machine may be easily and quickly enveloped in same in case of accident to film."

Sign and Outline Wiring.

"*Rule* 39*a*. Must be connected only to low-potential systems.

"*b*. Open or conduit work or metal trough construction may be used but molding will not be permitted.

"*c*. Where flexible tubing is required, the ends must be sealed and painted with moisture repellant and kept at least one half inch from surface wired over.

"*d*. Wires for use in rigid or flexible steel conduit must comply with requirements for unlined conduit work. Where armored cabled is used, the conductors must be protected from moisture by lead sheath between armor and insulation.

"*e*. Must be protected by its own cut-out, and controlled by its own switch. Cut-outs, switches, transformers, flashers and similar appliances must be of approved types and be installed as required by the Code for such appliances, and, if outside the building, must, with the exception of transformer of weatherproof type, be installed in approved weatherproof cabinets.

"*f*. Circuits must be so arranged that not more than 1,320 watts will be dependent upon one cut-out.

"*g*. Sockets and receptacles must be of the keyless porcelain type and wires must be soldered to lugs on same. Miniature receptacles will not be approved for outdoor work.

"*h*. For open work, wire must be rigidly supported on non-combustible, non-absorptive insulators, which separate the wires at least one inch from the surface wired over. Rigid supporting requires, under ordinary conditions where wiring over flat surfaces, supports at least every four and one-half feet. If the wires are liable to be disturbed, the distance between supports should be shortened. In those parts of circuits where wires are connected to approved receptacles which hold them at least one inch from surface wired over, and which are placed not over one foot apart, such receptacles will be considered to afford the necessary support and spacing of the wires. Between receptacles more than one foot, but less than two feet apart, an additional non-combustible, non-absorptive insulator maintaining a separation and spacing equivalent to the receptacles must be used. Except as above specified, wires must be kept apart at least two and one-half inches for voltages up to 300, and four inches for higher voltages.

"*i*. For metal trough construction, the troughs and other details must comply with the requirements of Rule 83 *a* to *f*, inclusive."

The Committee recommends that the fifth paragraph of Rule 83 *e* be revised to read:

"On outside of sign structure, except where open work is permitted, must be in approved metal conduit or in approved lead-sheathed armored cable."

Rubber-Covered Wires and Cables.

Rule 27*d*. Omit the following words: "at least one thirty-second inch in thickness."

Rule 49*a*. Revise by addition of a paragraph reading: "The copper of conductors shall not contain splices or joints."

Rule 50*j*. Change heading of this rule to read: "Lead-covered Wires and Cables for Interior Work Only (Type Letters R S L), except for Armored Cables (Type Letters A C)."

Change first paragraph to read: "Thickness of insulating wall of lead-sheathed rubber-covered conductors 0-600 volts to be the same for braided cables. Each conductor to be covered with a compound-filled tape or braid over the insulating wall. There shall be a tape or braid over the bunched conductors except where the conductors are laid parallel and not twisted. If braid is used it shall be, etc."

Rule 54*c*. Change second paragraph; revise by omitting the words: "and to keep the rubber compound from corroding the copper."

Rule 54*c*. Change second paragraph to read: "For use in damp places (Type Letter P. Wp.) the insulation must be at least three sixty-fourths of an inch thick when there is no extra layer of rubber between the outer cover and the flexible cord and must be at least one thirty-second of an inch thick when such layer of rubber is used. The cord must have, etc."

Change third paragraph, last part, to read: "Or providing there is an extra layer of rubber between the flexible cord and the outer cover, the insulation proper on each stranded conductor of cord may be one sixty-fourth of an inch in thickness for conductors of Nos. 18 and 16 B. & S. gauge, and one thirty-second of an inch for conductors of No. 14 B. & S. gauge, instead of as required for pendent cords."

Rule 56*b*. Change last part to read: "and in addition there must be a second outer fibrous covering, at least one thirty-second of an inch in thickness for wires larger than No. 10 B. & S. gauge, and at least one sixty-fourth of an inch in thickness for wires No. 10 B. & S. gauge or less in size; this fibrous covering to be sufficiently tenacious to withstand abrasion of being hauled through the conduit."

Rule 56*e*. Change last part to read: "which must be at least one-thirty-second of an inch in thickness for wires larger than No. 10 B. & S. gauge, and at least one sixty-fourth of an inch in thickness for wires No. 10 B. & S. gauge or less in size; this fibrous covering to be sufficiently tenacious to withstand abrasion of being hauled through the metal conduit."

Rule 57*b*. Add the following sentence: "If a lead-covered conductor is used the lead must be at least one-thirty-second of an inch in thickness."

Cabinet Committee.

Rule 70*g*. Amend first sentence to read: "Must close at all edges against rabbet formed as a part of the door or trim or must have turned flanges at all edges, so as to make cabinet dust tight."

Rule 70*a*. Change the last sentence in the paragraph following the fine print note: "Cabinets must be deep enough to allow the door to be closed when switches are thrown open as far as their construction and installation will permit them to be."

Committee on Sockets.

Rule 72*c*. Change second sentence to read: "Brass shells must be at least thirteen one-thousandths of an inch in thickness and for Mogul sockets not less than twenty-five thousandths of an inch, and shells of any other material must be thick enough to give equivalent stiffness and strength."

d. Change first sentence by substituting the word "metal" for "the," preceding the word "shells" in the first line. Change second sentence to read: "The material used for lining must be at least one thirty-second of an inch in thickness, and must be firm, compact and tough."

Omit third sentence.

Change second sentence of fine-print notes to standard type for rules to read as follows and precede the fine-print paragraphs: "The lining must not extend beyond the metal shell more than one eighth of an inch, but must prevent any current-carrying part of the lamp base from being exposed when a lamp is in the socket."

Change third sentence of fine-print note to read as follows and appear as first note: "The length of the candelabra lamp base is five-eighths of an inch, that of the medium lamp base is fifteen-sixteenths of an inch, and that of a Mogul lamp is one and five-eighths inches in a vertical plane from the bottom of the center contact to the upper edge of the screw shell."

e. Change first paragraph to read: "Caps when made of sheet brass must be at least thirteen one-thousandths of an inch in thickness and twenty-five one-thousandths for Mogul sockets, and when cast or made of other metals must be of equivalent strength.

"The inlet piece must contain sufficient metal for five full threads, and when not in one piece with the cap must be riveted or otherwise secured to give the strength of a single piece."

Omit second paragraph of fine-print note.

g. Change to read: "For candelabra sockets and medium size sockets rated at 250 volts, points of opposite polarity must everywhere be kept not less than three sixty-fourths of an inch apart, and for Mogul sockets and sockets rated at 600 volts not less than one eighth of an inch apart; provided, however, that in the event that substantial barriers of approved insulating material are used to separate such parts, these distances may be correspondingly reduced, but in no event must the separation distances measured over the surfaces of the barriers be less than those specified above."

j. Change to read: "The base on which current-carrying parts are mounted must be of porcelain or other non-combustible, non-absorptive insulating material approved for such use."

k. Change to read: "The key handle must not soften or become injured when used to operate the socket at a temperature of 200 degrees Fahrenheit. The handle should be thoroughly substantial and securely, but not necessarily, rigidly

attached to the spindle or lever which it is designed to control."

p. Add new paragraph as follows: "Lead wires permanently attached to sockets and sealed in place must have separately bushed outlets or be separated not less than one quarter of an inch in the clear. The wires must be stranded and have approved insulating coverings."

Report of Transformer Committee.

This committee advises that every transformer with either primary or secondary voltage over 550 volts be so designed and connected that the middle point of the secondary coil can be reached, if, at any future time, it should be desired to ground it.

The report also includes many suggestions concerning transformers not installed in fireproof vaults nor outside of buildings.

The report of the Committee on Laboratory Reports is confined mainly to recommendations as to the materials to be used in the manufacture of conduit and armored cable and to the tests which these products should be subjected to.

The report of the Committee on the New York Code covers changes incorporated in the 1912 edition of the municipal inspection rules of this city, and which were published in these columns when this edition of the rules made its appearance.

Suggested Changes in Rules.

In addition to the matters referred to in the foregoing committee reports, upon which final action, so far as the Electrical Committee is concerned, is expected to be taken at this meeting, the secretary will bring before the committee a number of other suggestions as to changes in the Code which have come to him since the Committee last met. These include recommendations that a table of sizes of motor leads for alternating-current machines be put into the Code; that there be a rule requiring the use of starting devices on certain types and sizes of motors; that an automatic circuit-breaker be allowed to take the place of both fuse and switch if it disconnects both wires and is free to operate while being closed; that the use of conduit be specified where service wires must be run on the walls of a building; and that where 1,320 watts is permitted on a branch circuit, 20-ampere fuses be allowed when the voltage is 110 and 10-ampere fuses where the pressure is 220 volts. It is further proposed that Rule 23*d* be changed to permit 1,000 watts on branch lighting circuits and that the maximum size of fuse permissible be made 10 amperes instead of 6. There is a suggestion that where the load is to be more than 500 amperes circuit-breakers instead of switches should be used at the service entrance. An amendment to Rule 26 is proposed which would require conduit for circuits on side walls, on open joists within 10 feet of the floor, and in all basements except such as are ceiled and floored and are dry. It proposed further to require conduit, metal molding or armored cable in the wiring of stables and similar buildings. There is a recommendation to prohibit wooden molding on ceilings where it would be exposed to mechanical injury, and that no iron-pipe protection be required where metal molding passes through a dry wall or partition; and so on.

Among the Contractors.

The Peake Electric Company, of Pensacola, Fla., has recently finished the wiring on the depot of the G. F. & A. Railway, the new railway line that has lately entered Pensacola.

J. Carley Gill, of Lyndhurst, N. J., is installing the electric wiring and fixtures in the new Masonic Temple in Rutherford, N. J.

William Dean, Oak Park, Ill., has been awarded the contract for the electrical work in the addition to the Holmes School.

The Wilson-Maltman Electric Company has been awarded the contract for the electric wiring in the residence for William H. Perkins, Jr. This residence is one of the largest in Baltimore, Md.

Cullen & Weitz has recently opened a place of business at 208 Madison Street, Tampa, Fla., where a general electrical contracting business will be conducted. A complete line of fixtures, carried in stock, is also contemplated. The firm is comprised of W. A. Cullen, E. F. Weitz and William E. S. Cullen, each of whom is widely experienced in the electrical business.

A. J. Anderson, president of A. J. Anderson & Company, one of the leading electrical contractors of Louisville, Ky., was recently elected president of the Builders' Exchange, a large and prosperous organization of the allied structural trades in that city. An expert in electrical contracting and steam-fitting, Mr. Anderson has long taken a prominent part in the doings of the organized trade in the Bluegrass metropolis, and his administration of the Exchange is expected to be a most successful one.

The Beaver Engineering Company, Newark, N. J., has been awarded the contract for electric wiring and elevator in the new Nurses' Home in Newark. The company has recently done several jobs out of town, including the Public Service Company Building in Elizabeth, the library building of St. Elizabeth Convent and one of the Bayonne public schools.

Blumenthal-Kahn Electric Company has been awarded the electrical contract for wiring the telephones, fire-alarms and bells in the apartment house that is being built at Druid Hill Park, one of the prettiest spots in Baltimore, Md.

The McKinney Electric Company, of Frankfort, Ky., is one of the newest contractors in the Kentucky field. It recently filed articles of incorporation. The company is capitalized at $2,000, with the following incorporators: Michael McKinney, Eugene Hoge and W. H. Hoge.

The Beattie Electrical Company, Toledo, O., has secured the contract for the electrical installation at the Glenwood School addition, which, when completed, will make this school the largest grade school in Toledo. Automatic temperature regulation will be furnished by the Johnson Electric Service Company.

The United Electrical Construction Company has been organized with offices at 417 South Dearborn Street, Chicago, Ill. The president of the new company is W. H. Rattenbury, who is also president of Arthur Frantzen Company, which has withdrawn from active operations in the electrical field. The secretary of the new company is William McGuineas and the treasurer is T. H. Rattenbury. The organizers of this company are men with considerable experience in electrical construction, as evidenced by their installations in the Cook County Court House, Chicago City Hall, Sears Roebuck & Company and the Blackstone and La Salle Hotels.

Contracts for more than $5,000 worth of electrical wiring and fixture installation have been secured by F. A. Clegg & Company, of Louisville, Ky., thereby proving that February is anything but the dull season of the year with Manager F. E. Good and his forces. Mr. Good recently returned from Pensacola, Fla., where a force of Clegg workmen is wiring, at a cost of $3,500, the handsome new passenger and freight depot of the Louisville & Nashville Railroad Company at that point. The Clegg company has contracted for the wiring in the Louisville Baptist Orphans' Home and for similar work in the newly erected annex of the Preston Hotel.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Changing the Tone of a Bell.

Electricians are frequently called upon to install additional bells in houses and factories where the new bells must have a different tone from bells already in use, and it may happen that the original installation will be found to include bells of so many different tones that to find one having a tone unlike all of the others will be impossible. In a case of this sort I

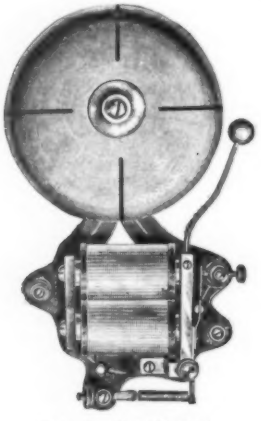


Fig. 1.—Slotted Bell.

have found it convenient to take standard bells and saw slots in them. The slots should be cut along the radial lines shown in the bell in Fig. 1. By cutting slots of one length in one bell and slots of other lengths in other bells, a variety of tones may be obtained although the gongs are all of the same size. George Reed.

Machinist's Vise Used as Pipe-Vise.

Not long ago I had some pipe to work in a shop where there was no pipe-vise, an ordinary machinist's or blacksmith's vise being the only thing of the kind available, and in this the conduit slipped so badly as to make the vise practically useless. To overcome the difficulty I took a piece of coarse sandpaper about three by six inches in size, and after doubling it, wrapped it around the pipe so as to put the paper between the jaws of the vise and the pipe. I found that the pipe could then be held rigidly enough to be cut and threaded without danger of slipping or making crooked threads.

W. F. Dimelow.

A Unique Job of Wiring Above a Metal Ceiling.

While doing some work in a department store, I had to fish circuits in a room having a satin-gloss metal ceiling with a hardwood floor above it, and I was cautioned that the ceiling and floor must not be marred any more than could possibly be avoided. I solved the problem without hurting the finish of the ceiling in the way explained below.

I cut out just enough of the ceiling for the outlet box and fished the wires in through the box itself. The most interesting thing about the job, however, was the method of supporting the outlet boxes. This is rather well shown in Fig. 3.

At every outlet the outlet box was secured to a piece of three-eighths-inch metal tubing. On the upper end of this there was a cap with a hole through the center of it, and through this hole a screw was passed into the flooring above, so as to provide support for the stem and outlet box. A long, thin screwdriver was used to go through the supporting stem in screwing the cap to the floor.

I always use this method of supporting boxes on fancy metal ceilings, and I find that it gives splendid satisfaction. M. J. Moriarty.

Convenient Control of Light in a Store.

In a recent job of store lighting, I saved considerable time and material by employing the method of lamp control illustrated in Fig. 2.

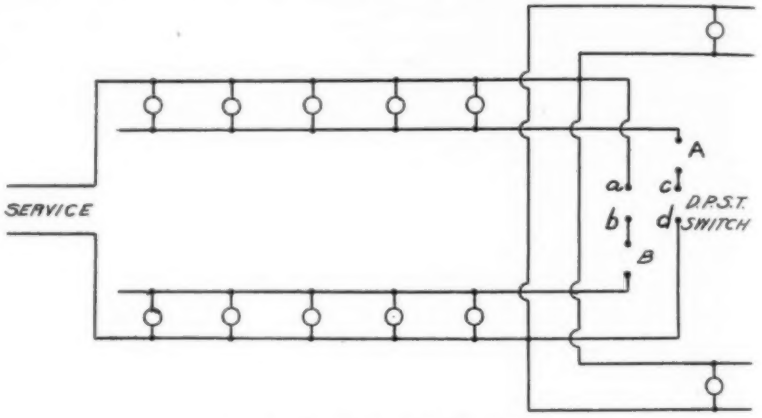


Fig. 2.—Circuits for Lighting Store.

It will be noted that opening the double-pole single-throw switch will put out both rows of lights, since it breaks the circuit between the points *a* and *b*, and *c* and *d*. The use of this sort of switch removed the necessity of running a third wire. By means of the single-pole switches *A* and *B*, each row of lamps may be controlled independently of the other.

L. E. Hegerberger.

Self-Starting Gas-Engine Generating Set.

In a small lighting plant where a gas engine generating set is used in conjunction with storage batteries, if the generator is compound wound a single-pole switch can be put in parallel with the series field so that when the switch is closed it practically cuts out the series field. By doing this, a shunt-wound motor with sufficient power to start the engine is secured.

J. M. Sewell.

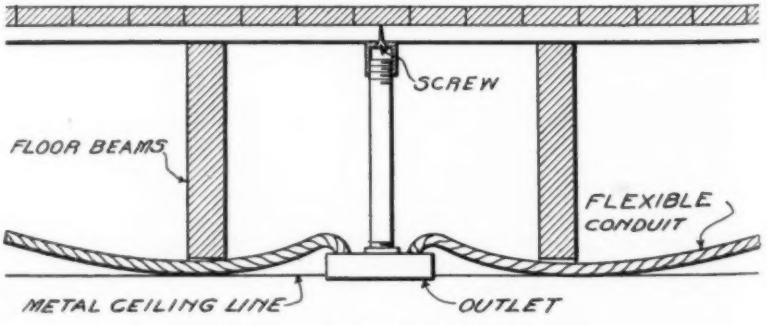


Fig. 3.—Method of Supporting Outlet Fittings.

Public Service Commissions

MARYLAND.

Through the Electrical Contractors' Association of Baltimore, Md., a complaint has been filed with the Public Service Commission against the Consolidated Gas, Electric Light & Power Company of that city. The complaint is that the company is discriminating against the electrical contractors and Joseph B. Dreisch, of the Association, pointed to two specific cases to demonstrate the contention that the Consolidated company is trying to enforce rules in regard to meter location and feeders, which are not followed by the company itself.

NEW YORK.

The Public Service Commission, Second District, has been notified by the New York Telephone Company that it has purchased the physical property and business of the Gowanda Bell Telephone & Telegraph Company, operating at Gowanda, N. Y., for the sum of $13,600.

The Commission has authorized the Heuvelton Light, Heat & Power Company to exercise franchises granted by the towns of Oswegatchie and DePeyster, St. Lawrence County, and to issue its common capital stock to the amount of $25,000 to purchase the property of Edward L. Thornton.

OHIO.

The Van Wert Public Service Company and the Delphos Electric Light & Power Company have received the approval of the Public Service Commission for a contract providing for an exchange of service. Either party will upon demand of the other furnish power not exceeding 500 kilowatts at the rates of two cents per kilowatt-hour.

In the complaint of the Western Union Telegraph Company against the Cleveland, Painesville & Eastern Railroad Company, stating that on the property of W. P. Murray, near Mentor, O., the three-phase transmission line has been placed at three points in ten spans vertically over the line of the complainant at a height not exceeding 40 inches, thereby creating a dangerous condition, the Commission has ordered the railroad company to install side-arms supported by brackets upon poles on this property so placed as to afford a clearance of not less than six feet between every high-tension line and the nearest wire of the telegraph company. Suitable strain insulators are also required. Similar spacing requirements are required in Painsville and in Willoughby Township.

A decision has been handed down by the Commission in the matter of the protest of Dayton physicians against the action of the Central Union Telephone Company, in charging $96 a year for special circuit connections between physicians' offices and residences. The physicians formerly paid $42 a year for the standard two-party office 'phone and $24 for the standard two-party residence service, the physicians, offices and homes being on the single circuits. The combined rate of $66 was increased to $96 a year by the telephone company, which is the company's single-line business rate of $60, and $36 a year for single-line residence 'phones. The physicians demurred and carried their grievance to the Commission. It held that the service whereby a physician or other person has his office and residence on the same circuit, is neither an individual nor a party line, but a special service and the defendant company was ordered to establish a rate in consonance with this special service, the rates not to exceed the company's present rates governing single-line service.

OKLAHOMA.

By order of the Corporation Commission, the Boynton Telephone Exchange at Boynton, Okla., is given 60 days to repair its plant so that it will be serviceable to its patrons. A complaint was registered with the Commission some time ago by J. W. Crawford and others, charging that the exchange was in such physical condition that the service was practically worthless.

MASSACHUSETTS.

The Massachusetts Railroad Commission has granted its approval of an issue of $600,000 par value of coupon or registered 20-year, six-per-cent bonds by the West End Street Railway Company, of Boston. The issue is for the purpose of paying in part the cost of permanent additions to and improvements made by the Boston Elevated Railway Company in accordance with the terms of the lease between the two companies. The Board also approves the West End Company's issue of 4,400 shares of common stock, amounting at par value to $220,000, for the purpose of paying in part the cost of additions and improvements made by the Boston Elevated Railway Company.

The Massachusetts Gas & Electric Light Commission has issued a decision in which it recommends that after March 1 the net price for gas supplied by the Attleboro Gas Light Company shall not exceed $1.00 a thousand feet.

At the hearing held on the complaint, the subject of what constituted a reasonable return on investment was gone into.

The Board says on the subject of surplus earnings that there is a growing recognition of the truth that a public-service company is not entitled to a return upon the unearned increment in value of its real estate, but investment out of profits which it has been able to make through the general growth of the community has similar attributes. It has been unlawful in Massachusetts for many years for a public-service corporation to represent its surplus in new capital by a stock dividend. The Board finds it difficult to see why the reasonable amount of return, based upon the full value of the company's property, should not be affected in the same manner by that portion of the investment made from unearned increment in its profits as by the unearned increment of value in its real estate. On the subject of depreciation the Board holds that the company's claim of four per cent upon its entire plant is too high. The land occupied by the company has increased in value since it was purchased. The cast-iron mains show a depreciation of less than four per cent. Provision for the renewal of meters has been made through operating costs. The Board says that even if the works are to be rebuilt on a new location and the present works abandoned, the remaining plant will be worth more than all the actual investment made by stockholders.

Among the Supply Men

Electrical Supply Jobbers' Meeting.

The midwinter meeting of the Electrical Supply Jobbers' Association was held at the Hotel Lafayette, Buffalo, N. Y., Tuesday and Wednesday, February 11 and 12. It was originally intended to hold another session on Thursday, but prompt attendance at the meetings and vigorous prosecution of business in hand rendered the extra day unnecessary.

Among the matters of immediate importance discussed was the question of the jobbers' attitude with regard to the revision of National Electrical Code rules with reference to refillable fuses. This question has been before the Electrical committee of the National Fire Protection Association and will be up for discussion at the meeting of the electrical committee which will be held at New York March 26 and 27. The general opinion appeared to be opposed to any change in the Code on the enclosed fuse question. As to cost of doing business reports indicated that the average increase during 1912 had been about 0.5 per cent.

Franklin Overbagh was re-elected secretary, and as a tribute to his efficiency for many years in this office the work of treasurer was combined with that of the secretary's office and placed upon his able shoulders. N. G. Harvey, general manager of the Illinois Electric Company, Chicago, was elected chairman of the Central division, and Frank S. Price, secretary and general manager of the Pettingell-Andrews Company, Boston, was elected chairman of the Atlantic Division. The plans of the Society for Electrical Development, Incorporated, were presented by W. E. Robertson, general manager of the Robertson-Cataract Company, Buffalo. Mr. Robertson is one of the incorporators of the Society and with W. W. Low, Chicago; Gerard Swope, New York; F. S. Price, Boston, and Roger Scudder, St. Louis, represents the Jobbers on the board of directors. There were over three hundred jobbers and manufacturers in attendance, among whom were the following:

H. C. Adams, Pawtucket; W. L. Adams, Providence; S. H. Anderson, Pittsburgh.

A. E. Beling, Pittsburgh; J. H. Burns, Buffalo; E. G. Bernard, Troy; J. B. Baker, New York; F. C. Barrington, New York; William A. Browne, Chicago; E. Bartram, Philadelphia; F. S. Baldwin, New York; F. M. Bernardin, Kansas City; F. V. Burton, Bridgeport; A. Hall Berry, New York; Frank Brookfield, New York; W. F. Bissell, Toledo; P. F. Bauder, Cleveland; F. R. Bryant, Chicago; T. H. Bibber, New York; C. F. Boynton, New York; H. A. Brereton, Buffalo.

Oscar Carman, Indianapolis; C. M. Crofoot, Cincinnati; N. C. Cotabish, Cleveland; H. H. Cudmore, Cleveland; M. F. Cronin, Chicago; C. E. Corrigan, Pittsburgh; LeRoy Clark, Englewood; H. B. Crouse, Syracuse; S. B. Condit, Jr., Boston; S. A. Chase, Pittsburgh; W. H. Colman, Chicago; W. P. Crockett, Chicago; J. H. Cudmore, Cleveland.

F. L. Dunbar, Bristol; P. S. Dodd, New York; W. J. Doherty, Montreal; B. B. Downs, St. Paul; A. E. Durin, Cedar Rapids; T. M. Debevoise, New York; L. N. Downes, Providence; B. M. Downs, Covington; J. W. Demich, Philadelphia; V. R. Despard, Chicago; J. C. Dallam, Schenectady; T. E. Devine, Buffalo.

A. P. Eckert, New York; R. Edwards, Jr., New York; J. B. Esterbrook, Warren; G. W. Elliott, New York; W. E. Evans, Covington; C. L. Eshleman, Cleveland.

F. R. Fortune, Pittsburgh; H. C. Farnsworth, Boston.

J. M. Griffin, Schenectady; W. M. Gloeckner, Philadelphia; Edward R. Grier, Hartford; A. C. Garrison, St. Louis; H. L. Grant, Chicago; Thomas G. Grier, Chicago; H. S. Greene, Cleveland; L. Griesser, Cleveland; R. E. Gorton, Warren; G. C. Griffing, Milwaukee; L. V. Garron, Philadelphia; A. A. Gray, Chicago; A. A. Guardia, Chicago.

F. M. Hawkins, New York; C. L. Hight, New York; H. H. Hornsby, New York; E. H. Haughton, Chicago; C. R. Hunt, Chicago; W. R. Herstein, Memphis; H. W. Hall, Richmond; C. A. Harding, Chicago; C. B. Hawley, Salt Lake City; N. G. Harvey, Chicago; J. W. Ham, Schenectady; E. B. Hatch, Hartford; C. I. Hills, Hartford; S. A. Hobson, Chicago; W. M. Hoagland, Chicago; H. W. Hoover, New Berlin; F. W. Howard, Pittsburgh.

G. V. W. Ingham, Chicago.

R. M. Jones, Chicago; J. G. Johannesen, Baltimore; R. L. Jaynes, Pittsburgh.

W. B. Kinkead, New York; H. B. Kirkland, Pittsburgh; Frank Kuhn, Detroit; P. S. Klees, Hartford; F. A. Ketcham, Chicago; L. W. Kittman, Chicago; George C. Knott, Montreal; Basil G. Kodjbanoff, New York; L. H. Keeler, New York; F. D. Killon, Chicago; E. B. Kittle, Chicago.

A. W. Lindgren, Duluth; W. F. Lewis, Pittsburgh; W. W. Low, Chicago; Arthur Lockwood, New York; A. M. Little, Syracuse; P. F. Lyons, Chicago.

H. P. Moore, Newburyport; F. D. Masterson, Boston; C. S. McKinstry, Cleveland, C. G. McGreevy, Syracuse; Max McGraw, Sioux City; E. B. Mallory, New York; J. H. McGill, Valparaiso; L. T. Millner, Cincinnati; W. N. Matthews, St. Louis; J. R. McNaughton, Detroit; H. F. MacGuyer, Providence; W. H. McCombs, Pittsburgh; J. B. McCarthy, Detroit; Albert Mann, Boston.

E. E. Nash, Warren.

M. A. Oberlander, New York; Franklin Overbagh, Chicago.

J. P. Provost, Pittsburgh; D. T. Pierce, New York; J. A. Pizzini, New York; L. F. Philo, Buffalo; W. T. Pringle, Philadelphia; H. E. Page, Hartford; C. McKew Parr, Hartford; G. L. Patterson, New York; J. D. Presbrey, Cleveland; R. H. Phillips, New York; F. S. Price, Boston; A. D. Page, Newark; F. L. Pardee, Buffalo.

C. Russell, Albany; James Richardson, Minneapolis; W. E. Robertson, Buffalo; J. D. Robertson, Buffalo; C. W. Ridinger, Pittsburgh; E. W. Rockafellow, New York; T. C. Ringgold, Chicago; K. G. Rennie, St. Joseph; J. H. Rogers, Pittsburgh.

Henry D. Sears, Boston; Frank Stout, Plainfield; E. M. Scribner, Chicago; A. J. Selzer, Chicago; E. A. Seabury, Omaha; L. O. Schwab, Chicago; F. F. Skeel, Chicago; C. C. Sibley, New York; B. E. Salisbury, Syracuse; B. H. Scranton, Detroit; Eugene Smith, Cincinnati; Herbert Sinclair, Trenton; W. D. Steele, Chicago; H. I. Sackett, Syracuse; E. B. Strong, San Francisco; J. M. Smith, Cleveland.

W. J. Tonkin, Providence; J. H. Trumbull, Hartford; G. L. Thompson, Philadelphia; F. B. Thompson, St. Paul; F. Tresselt, New York.

J. A. Vaughan, Philadelphia.

L. A. Woolley, Buffalo; J. A. Worth, Milwaukee; C. D. Wilkinson, Minneapolis; H. L. Walker, Detroit; A. E. Williams, Warren; H. R. Worthington, Jacksonville; James Wolff, Chicago; W. Weiss, St. Paul; Bruce Wetmore, Boston; Glenn C. Webster, Conneaut; A. B. Wilson, Conneaut; R. L. Wildauer, Chicago.

On Tuesday evening 37 neophites were initiated into the Jovian Order at a rejuvenation held at Scottish Rite Hall, some two hundred and fifteen Jovians being in attendance. The floor work was well done, and after the rejuvenation a cabaret entertainment and supper was given in the grill of the Lafayette Hotel. The vaudeville topliners were ably assisted by "Billy" Robertson and "Cuddy."

The next meeting will be held at Chicago May 26, 27 and 28. "Nate" Harvey, as chairman of the Central Division, has already started naming committees, and as a special feature is planning a sham battle on Lake Michigan. Other features are being suggested every day, to be announced later on.

The Central Electric Company, Chicago, Ill., has begun the publication of a monthly bulletin called *The Electron*. The February issue contains a description of an interesting installation for the illumination of the new office building of the Chicago, Burlington & Quincy Railroad, an article entitled "The Rise of a Master Contractor," by the editor of the bulletin, A. M. Minnick, and a *magnum opus*, by George A. McKinlock, president of the Central Electric Company, outlining the aims and opportunities of the bulletin. There are also other editorial features of particular interest to the contractor and distributing trade. The bulletin is a lively, entertaining little publication, and will be well received by the big field covered by the Central Electric Company.

I. E. Greene, district manager of the H. C. Roberts Electric Supply Company's Syracuse house, says that business for the past year has been on an average of about 50-per-cent improvement over the previous year, and that even though these are the dull months the activity seems to keep up just as

it has for the last 12 months. Collections are not bad, and the average electrical contractor in their neck of the woods is doing enough business to take care of his bills if he wants to. In Syracuse particularly it would appear that the 56 contracting concerns are so busy that it is almost impossible to get a small repair job done, because of the large work that everybody is now engaged in. The company has just issued a big catalog, No. 27, containing over 750 pages. This is a mighty complete illustrated description and listing of practically everything of an electrical nature. As the catalog does not illustrate any parallel lines, it is a matter of easy reference to find anything desired, and the catalog is more useful because a good deal more material can be illustrated in a given space.

G. A. Seabury, of the Mid-West Electric Company, Omaha, Neb., informs us that his company held a very successful sales conference recently, which was attended by a large number of representatives of eastern manufacturers. R. H. Bastain of this company has been transferred to a better territory, which will include part of the state of Iowa.

The Commercial Electrical Supply Company of St. Louis, Mo., reports that it is conducting a special sales campaign on fan motors, and so far has closed at least fifty per cent more contracts than for the same period last year. Indications are that 1913 will be an exceptionally good fan year. Since the close of a sales conference in January, several changes have been made in the organization. The company has recently created a new department, known as an "Apparatus Department," said department to have charge not only of the selling of motors, generators and reconstructed apparatus, in which the company deals largely, but also of the introduction of the new "Commercial Farm Lighting System." A great many agencies have been established, and more than 50 outfits have been sold since the first of the year.

W. R. Thomas, president of the Columbian Electrical Company, St. Joseph, Mo., writes that his company is conducting a special sales campaign on all kinds of apparatus and supplies, both electric light and telephone, selling the latter to independent companies only. Business is in a better condition than it has been for a long time, and the company's salesmen report unusual business from Kansas and Southern Nebraska. Another sales conference will be held in April, at which time two salesmen will be sent out to cover the western territory generally.

M. B. Austin, president of M. B. Austin & Company, returned to Chicago on February 17 after an absence of about a month. Mr. Austin spent a couple of weeks in the East visiting the factories manufacturing the lines for which his company is the western distributer, and spent two weeks at Bermuda, going to and from that famous resort by way of New York. Mr. Austin returns in splendid spirits and health, and reports the business outlook entirely satisfactory. He reports particularly that the business of the Safety Insulated Wire & Cable Company in all its lines was very good during 1912, and that the outlook for 1913 gives every assurance of a big year.

The Inland Electric Company has opened a new store and warehouse at 14 and 16 North Franklin Street, Chicago, Ill. The company occupies the first floor and basement, with approximately 10,000 square feet of space. The company has a ground-floor store and pleasantly located offices, and will deal in a general electrical supply jobbing business. There will be a retail department handled in conjunction with the jobbing department, with two men always available at the retail counter. The officers are E. A. Nyquist, president, D. E. Wescott, secretary, and H. Larson, treasurer. All of these men were formerly connected with the Illinois Electric Company, and have had from ten to fifteen years' experience in the supply business. Mr. Nyquist is especially familiar with the details of filling orders and the purchasing of general supplies, and Mr. Wescott is a well known traveling representative in Indiana and Michigan. He is a thoroughly practical man, having for many years been connected with electric lighting and street-railway companies. Mr. Larson has had a long experience in the credit and collection department. The company's operations will cover parts of Michigan and Indiana, all of Illinois, Iowa and Wisconsin and part of Minnesota. There are two men on the road and they will have two more men out by March 1. At the present time three men are devoting their entire time to Chicago and Cook County. Among the lines handled by the company are those of the Sterling Electric Lamp Works, Central Tube Company, Appleton unilets and fittings, and standard electric wiring devices manufactured by Perkins, Bryant and Arrow companies. Mr. Nyquist reports that business and collections are very good.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 119.—Mechanical Rectifiers.—What is the efficiency of vibrating and similar mechanical rectifiers compared with that of mercury-arc rectifiers? What is the highest current that can be rectified by them without destructive sparking? Can they be used on circuits higher than 110 volts?—J. B. D., Springfield, Mo.

No. 123.—Scrap Value of Tungsten Lamps.—I understand that tungsten is an expensive metal and therefore wish to find out whether burned-out or broken-filament tungsten lamps have any scrap value. What firms, if any, buy them? Can they be refilled like carbon-filament lamps?—T. N. S., Sandusky, O.

No. 124.—Vehicle-Battery Charging.—What is the most reliable device to cut off the charge on an electric vehicle battery automatically when the battery is fully charged?—S. B. F., Fort Wayne, Ind.

No. 125.—Electric Thawing of Frozen Galvanized Pipe.—We have been doing quite a little pipe thawing, using our secondary circuits and getting excellent results. We have not found to date a pipe that we could not thaw out. One of our customers claimed, however, that thawing out a galvanized pipe by electricity had the effect of deteriorating the galvanizing and hence shortening the life of the pipe. Can some of your readers throw light on this point?—A. E. A., Laramie, Wyo.

No. 126—Automatic-Reset Annunciator.—How can an automatic-reset annunciator be made to reset itself when receiving its current from a bell transformer? I have had several which would not reset regardless of adjustment, but in all cases the bell would ring.—J. L. H., Rock Island, Ill.

No. 127.—Deterioration of Conduit in Concrete.—After conduit has been in concrete for a few weeks I have found that it becomes very brittle at the point where it leaves the concrete. I would like to know whether any of your readers has had the same experience in a concrete building.—C. F. C., Albany, Ore.

No. 128.—Tungsten Lamps on Combination Trolley Poles.—Have any tests

been made, or records kept, of the comparative life of drawn-wire tungsten lamps when mounted in clusters on independent ornamental posts and when mounted in clusters on combination trolley and light poles? Is it customary to use shock absorbers when using combination poles?—P. T. N., Charlotte, N. C.

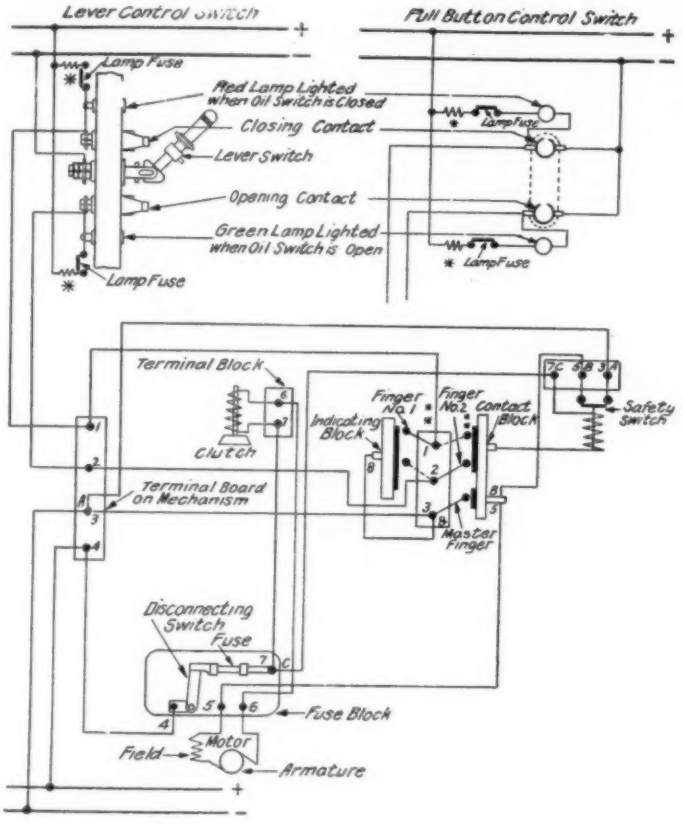
Answers.

No. 107.—Thermal Cutout for Flatirons.—I understand that there have been patented several thermal cutouts for use with electric flatirons to open the circuit automatically when a certain temperature is reached and thus prevent burning out of the heating element. Has any iron on the market been equipped with a device of this kind that is both reliable and foolproof, so that it can be entrusted to the ordinary household servant?—W. L., Beloit, Wis.

My attention has just been called to this query. The Dover Manufacturing Company, of this city, manufactures a completely successful automatic-heat-controlled electric iron. The make and break of the circuit is made by a thermostat, which differs somewhat from the regular thermostat usually employed for this purpose. A metal bar, made from an alloy imported from England and which has a very high coefficient of expansion, is used. This bar is rigidly riveted and also fastened by two machine screws at the ends to a steel bar in such a way that the alloy bar is bowed in the center. As the iron becomes heated, the alloy bar expands a certain part of an inch for each additional degree of heat. However, as it is rigidly fastened at both ends, the bar must bow out more in the center. By doing so it breaks the circuit of the iron between two platinum-tipped contact points, one of these being fastened to the thermostatic bar itself and the other contact point being fastened to a steel spring located directly above the thermostatic bar. This upper contact is made adjustable so that a greater or less degree of heat can be obtained. The variation of temperature is accomplished by means of an outside spring to which is fastened an insulated thumb screw. The latter makes contact with an insulated cap which rests on the inside temperature spring that carries the upper contact point. By putting more or less tension on this spring it is easily possible to regulate the temperature of the iron at will. The iron is absolutely automatic and will maintain its temperature constant with a variation of not over five degrees between maximum and minimum points. The advantages of such an iron are too numerous to mention in this brief communication, but among the more important ones are: non-scorching of the goods being ironed, fire risk practically eliminated, high economy obtained by keeping iron at a constant temperature. As to the practicability of the device, it need only be said that over 20,000 of these irons are in use in various parts of the country.—W. A. B., Canal Dover, O.

No. 115.—Oil Switch.—What causes a type F, form H3, 300-ampere, 15,000-volt, General Electric oil switch to close from itself when tripped for the opening position and to open from itself when tripped for a closed position?—C. W. J., Chicago, Ill.

I believe the leads coming from the terminal block on the switch got crossed in some way when the switch was wired up. Possibly the wiring on the switch itself is wrong. If the switch is wired up in the way shown in the accompanying diagram, it will operate as it should, according to whatever position the controlling switch is in.—J. B., Minneapolis, Minn.



* Lamp resistance to be used for voltage above 125 volts.

** Finger No. 1 makes connection on contact block when oil switch is open and on indicating block when oil switch is closed. Finger No. 2 makes connection on contact block when oil switch is closed and on indicating block when oil switch is open.

No. 115.—Control Wiring for Type F, Form H3 Oil Switch.

No. 118.—Aluminum Plating. — Can aluminum be electroplated on brass objects just like nickel? If so, what solution is used and what strength of current is suitable?—N. P., Fort Worth, Tex.

According to Borcher's "Electric Smelting and Refining," theory points to the possibility of depositing aluminum from aqueous solutions, but up to the present time, no one seems to have done it. An early English patent (Thomas and Tilley, British patent No. 2,756 of 1855) claims that it is possible to electrolyze an aqueous solution of aluminum hydroxide (freshly precipitated) in potassium cyanide, while in 1887, Reinbold (*Jewellers' Journal*), claimed that an electrolyzable mixture was: Alum, 50 parts; water, 300 parts; then add 10 parts aluminum chloride and heat to 93 degrees centigrade. After cooling, add 39 parts potassium cyanide and electrolyze, using an aluminum anode and a low current density. This last may perhaps be feasible, though I have never seen anyone who claimed that aluminum could be obtained electrolytically except from fused salts.—Donald M. Liddell, Elizabeth, N. J.

Although aluminum is generally credited with indestructible qualities and high resistance to corrosion, it has but few qualities that would make it advantageous as an electrodeposit upon other metals; for, while it resists atmospheric action when in a massive state and retains a certain brightness for a long time, when it is deposited electrically from an aqueous solution, which deposit is of necessity of a more or less porous nature, it soon tarnishes and assumes a dull bluish-white color on exposure to the direct action of the elements. Aluminum is with-

out doubt harder to deposit than other more common metals. This is because of the high voltage necessary to decompose aqueous aluminum solutions, and its tendency to redissolve after being deposited. I find that using a solution of aluminum that had but a very slight dissolving effect on the metal and a current density of about eight amperes per square foot and an electromotive force of 6.5 to 7 volts, aluminum can be deposited on the cathode at a rate of one grain per hour per square foot, in a reguline state, and with a greater density it can be deposited much faster but is in a pulverized state which does not adhere well. A test that I have just completed consisted of plating small copper plates with aluminum. The test was made in a fairly large tank using a solution of aluminum chloride to which was added sodium chloride. This readily formed a double chloride of aluminum, which added to sufficient ammonium chloride formed the bath. It was kept at a temperature of 80 to 150 degrees Fahrenheit and the electromotive force varied from 0.7 to 10.0 volts. Results of this test are as follows: The temperature of the bath, if kept between the limits of 80 to 150 degrees Fahrenheit did not alter the tenacity of the finish, only causing the color to change slightly. From 0.7 to 1.5 volts the deposits were very irregular, highly granular and of no definite color. Abundance of gas was given off and in places the deposit was dirty and granular with no appearance of aluminum in any other condition except at times under the thin slimy coat there appeared a white coating of metal which had good adhesion to the base. As the electromotive force was raised to 6.5 to 10 volts the plating improved and a more regular clear-white deposit capable of taking a good polish appeared, followed at higher voltage by a highly granular and useless deposit. The process is exceedingly wasteful on account of the tendency of the water to decompose at the higher electromotive forces. To this cause is due, I believe, the irregular action of the bath. The conclusion brings us to the fact that such plating is of no practical value on account of the difficulty of getting a solution capable of being worked at a low electromotive force.—H. E. W., Chicago.

No. 120.—ELECTRIC BLEACHING.—I have heard the statement made that some laundries whiten or bleach the clothes artificially by sending electric current through a tank into which the clothes are put before drying. Where is this method used and how is it carried out?—M. C., Erie, Pa.

It is true that electricity is now being used in laundries for bleaching purposes and the success with which it is meeting indicates a general substitution of this method for the harmful bleaching compounds heretofore used. Chloride of lime was one of the first chemicals used for bleaching; later soda was added, but this only slightly improved conditions. Recently there has come upon the market another compound, which is said to be less harmful than any yet devised, but this also is a ruinous compound, and these compounds in their relation to bleaching linen or cotton fabrics will always of necessity be more or less injurious. The foregoing is simply mentioned to emphasize the value of the electrical method. Regardless of the actual monetary saving to the laundryman, the fact that the electric bleach is absolutely harmless to fabrics is of sufficient importance to have it supersede chemicals and to be demanded by the public generally. In the electrical operation the textile is not bleached artificially but naturally. Brine made from one pound of salt dissolved in three gallons of water is passed through a stone vat filled with carbon baffle plates. Current is passed through the cell, this dividing the elements chemically, producing what is known as hypochlorite of sodium, containing three grains of free chlorine per liter. This chlorine is contained in the liquid from the brine which flows into a container at the rate of 20 gallons per hour. When the clothes are passed through the washer in the second suds about a pail full of this chlorine liquid is added to a 75-shirt capacity washer producing a pure white, clean-smelling linen. The device for producing this bleach is known as the Chlorinator and requires direct current of 25 ampere capacity at a pressure of 110, 220 or 550 volts. The cost of making the bleach is about one-fourth of one cent for each gallon. A few of the prominent laundries in Chicago using this process are The Paris Laundry, The Central Laundry and Wouters Laundry, Cook County Hospital, etc. There is also another method of bleaching clothes electrically in which the energy is applied directly to the wash wheel. The operation of this device is based on the principle that it is the sediment of the bleach that harms the fabrics and that oxygen produced by passing an electric current through water has no sediment. The device used for this process consists simply of two metal plates attached to the inner portion of the wash wheel. One plate is negative and the other positive and connection is made to an ordinary lighting circuit, the water in the wheel completing the circuit between the two plates. No data are available regarding the cost of this process.—Theodore Blech, Waukegan, Ill.

Coal Production in Alabama.

The general belief among those conversant with the coal-mining situation in Alabama is that the production in 1912 approximated 18,000,000 short tons, the largest tonnage in the history of the state.

DINNER TO ELECTRICAL CONTRACTORS.

The Brooklyn Edison Company Entertains at the Union League Club.

Over 400 were present last Saturday night at the annual dinner of the Brooklyn, N. Y., Edison Company to the Brooklyn electrical contractors, at the Union League Club in that city. The banquet hall was artistically decorated with hundreds of electric bulbs of various hues.

Theodore I. Jones, general sales agent of the company, was toastmaster.

Public Works Commissioner Lewis H. Pounds, responding to the toast "The Borough of Brooklyn," paid a high compliment to the Edison Company, and spoke of the satisfactory relations that exist between his department and the company.

Public Service Commissioner Milo R. Maltbie had a great many good things to say too, repeating the attitude of the Brooklyn Edison Company, and the effort the company always made to be entirely right before going ahead with is work.

Other speakers and their toasts were: John P. Bonney, president of the Kilowatt Club, "Brooklyn Contractors"; Charles L. Eidlitz, past president of the National Electrical Contractors' Association, "The Co-operative Movement"; J. C. Forsythe, chief inspector New York Board of Fire Underwriters, "The Underwriters' Work," and Douglas Burdett, of Baltimore, spoke on subject of "Service First," urging that electric-light companies should not permit delays and excuses for them to customers, but at all times work with the idea of service first.

Mr. Jones, the toastmaster, in conclusion spoke of the regretted absence of the newly elected general manager, W. F. Wells, through illness in his family, and expressed the great satisfaction of the entire staff of the Edison company, that in selecting Mr. Wells the directors had not gone away from home, and he thanked T. S. Murray, one of the directors of the company, who was present, for his efforts in bringing recognition and advancement to one of the boys of the Brooklyn Edison Company.

Southern Power Company to Build New Plant.

The Southern Power Company, of Charlotte, N. C., has completed plans for the construction of a hydroelectric plant at Lookout Shoals on the Catawba River, 12 miles from Statesville. The present equipment will comprise four units of 400 horsepower each. W. S. Lee, chief engineer of the company, is in charge of the project.

BOOK REVIEWS.

"Wireless Telegraphy and Telephony." By Alfred P. Morgan. New York: The Norman W. Henley Publishing Company. Cloth, 154 pages (5x7¼ inches), 156 illustrations. Supplied by the Electrical Review Publishing Company for $1.00.

This book treats the subject of wireless telegraphy in a popular manner without any attempt to enter into the engineering and constructive details. Mechanical analogies are brought in to illustrate to the non-technical reader the mode of action of the electrical apparatus involved and the apparatus for wireless telegraphy and the method of using it are simply explained. One chapter is also devoted to the wireless telephone.

"A Handbook of Incandescent Lamp Illumination." Harrison, N. J.: General Electric Company. Flexible cover, 147 pages, pocket size. Price, 50 cents.

This is a vest-pocket handbook of data and illumination diagrams relating to the use of incandescent lamps, with the necessary explanatory matter and definitions. It should prove of value to illuminating engineers, solicitors of central stations, salesmen for lamps and lighting equipment, and users of incandescent lamps.

"Primary Battery Ignition." By C. Wadsworth Jr. New York: D. Van Nostrand Company. Cloth, 78 pages (4¼x7 inches), illustrated. Supplied by the Electrical Review Publishing Company for 50 cents.

This volume is intended to familiarize the user of the gasoline engine with the characteristics of primary batteries used for ignition and with the ignition troubles which may occur with their use. No prior knowledge of electrical phenomena is assumed. The operation of both wet and dry cells is explained, as well as methods of locating trouble with them. It thus forms a simple, practical guide, acquainting the reader with the function of the primary cell, the various methods of connection, and the means and advantages of testing them. The admonition against dependence upon short-circuit tests of cells might have been even more emphasized. Attention is very properly called to the relation between the value of the current used and the operation of the ignition system, and to the use of an ammeter for indicating the cause of poor operation.

"Motors, Secondary Batteries, Measuring Instruments and Switchgear." By S. Kenneth Broadfoot. New York: D. Van Nostrand Company. Cloth, 96 pages (4x6 inches), illustrated. Supplied by the Electrical Review Publishing Company for 75 cents.

This little volume contains much condensed information upon the four subjects indicated in its title, but of course none of them can be considered very thoroughly in the small space allotted. The elements of the subject are, however, stated in a concise way and illustrative diagrams given. The point of view and some of the details of apparatus mentioned apply to English practice. The practical man should find many valuable hints in it, and the opportunity of refreshing his memory upon those subjects with which he does not deal frequently.

"Practical Mathematics for the Engineer and Electrician." By Elmer E. Burns and Joseph G. Branch. Chicago: The Joseph G. Branch Publishing Company. Cloth, 143 pages (5x7½ inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.00.

The authors of this volume have assumed that the reader knows but little of mathematics and have taken up the more important computations that are likely to appear in the work of the practical engineer, beginning with the elementary work in fractions, decimals, etc. The more common trigonometric functions are considered and a short introduction to algebra given. The use of logarithms, without any discussion of the principles upon which their use is based is explained. Examples are given for the working out of problems and some of these apply to electrical subjects. A copper-wire table is included.

New Patent Office Building Provided For.

The Sundry Civil Bill, carrying a total in appropriations of $113,151,614.66, was reported to the United States House of Representatives on February 17. It provides for a new Patent Office building in Washington, setting aside $225,000 for the purpose, the building to be erected inside of the court of the present Patent Office. It is to be a separate structure of glass, iron and steel. This item, of course, has the backing of the powerful Committee on Appropriations, and it stands a good chance of being retained in the bill when passed.

Another item in the bill is for nearly a million and a half dollars to establish in Washington a Government heating and lighting plant. This item is the direct outgrowth of the report of the Cleveland Economy and Efficiency Commission, in which it was pointed out that the Government is losing many thousands of dollars annually by not having its own lighting plant for government buildings in the capital. The central plant is to be built on Water Street between Thirteenth and Thirteenth-and-a-Half Streets and it will supply the Bureau of Engraving and Printing, the Department of Agriculture, the Treasury, the White House, the State, War and Navy Departments, the Winder Building, the Mills Building, the Court of Claims Building, the old and new buildings of the National Museum, the Smithsonian Institution, the Medical Museum, the Fish Commission Building, the Washington Monument, the District Building, the Post Office Department and the new buildings of the Departments of State, Justice and Labor. To start the work $150,000 is to be available immediately.

No Federal Tax on Water Powers.

After debating the proposition, off and on, for several weeks, the United States Senate on February 17 refused to give its sanction to the proposal to place a federal tax on water powers.

The question came up on the final passage of the bill permitting the Connecticut River Power Company to reconstruct and relocate a dam at Windsor Locks, Conn. The proposal to give the Government the right to impose "a reasonable annual rental", upon water-power privileges, which was left to the discretion of the Secretary of War, was defeated by a vote of 53 to 29. Senator Bankhead offered an amendment to the bill to strike out the federal-tax plan, and it was adopted.

The Senate then passed the bill, simply permitting the Connecticut River Power Company to reconstruct its dam near Windsor Locks, under the usual terms affecting the navigation rights of the Government, customary in bills granting water-power privileges in rivers and other waters. The vote was 74 to 12.

The bill as passed, however, contains an amendment offered by Senator Borah, which was passed, making hydroelectric companies common carriers and subject to the laws and regulations of the Inter-State Commerce Commission, and an amendment offered by Senator Jones, providing for the cancellation of the lease granted by the bill to the Connecticut River Power Company if it ever becomes a part of any water-power combination or monopoly.

Hydroelectric Power for Columbia.

The Columbia Gas & Electric Company, Columbia, S. C., having recently acquired the Parr Shoals Power Company, will start construction immediately of the Parr Shoals hydroelectric station, on the Broad River about 20 miles north of Columbia. It is planned to ultimately develop 25,000 horsepower.

Power will be transmitted to Columbia at 66,000 volts over a double steel-tower transmission line. Cotton mills in the vicinity will also be supplied.

The Wichita White Way.

The white way in Wichita, Kans., consists of five miles of lamps. For half of this distance, the city's principal streets are lighted by General Electric four-ampere magnetite arc lamps strung on ornamental iron poles 100 feet apart. The poles are fed from an underground conduit consisting of six 2.5-inch J. & M. fiber ducts laid in concrete. The specially made cable, No. 8 copper, was furnished and installed by the Standard Underground Cable Company. There is a service box 3 by 3 feet at each pole and a manhole 5 feet square and 6 feet deep located diagonally at each street intersection. An average of 100 men per day for five months was required to install the conduit. The city, the street-car company and the Kansas Gas and Electric Company joined in the enterprise. The poles support the trolley wires and the arc lamps at the same time.

Fig. 1.—Illumination of Douglas Avenue.

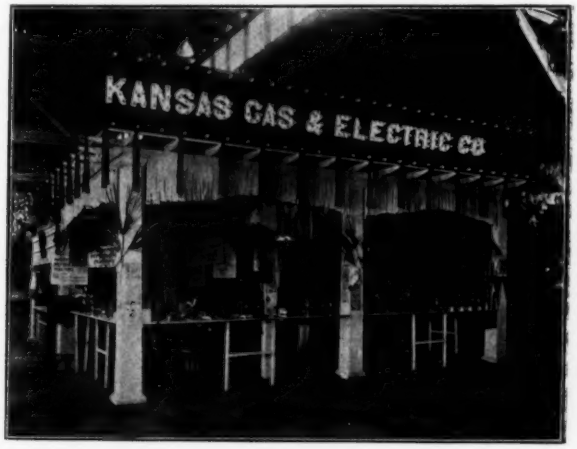


Fig. 2.—Exhibit of Kansas Gas & Electric Company.

Fig. 1 is a night view of Douglas Avenue looking east from Water Street, during the Fall Festivities and Carnival held from October 2 to 12, 1912. The lights of the white way were turned on for the first time on October 2, at 7 p. m. Miss Sidney Clapp, queen of the Fall Festivities, turned the switch which flooded the streets with a brilliant light, and upon the platform with her were Mayor W. W. Minick, H. S. Sladen, manager of the Kansas Gas and Electric Company, R. B. Campbell, commissioner of Water and Lights, G. M. Booth, chairman of the Committee of Arrangements, and other prominent citizens.

The occasion was heightened on account of its being the opening of the great exposition at the Forum, Wichita's big municipal auditorium where the merchants, manufacturers and horticulturists of a half-dozen states produced an interesting and instructive display of their products.

Fig. 2 shows the display of the Kansas Gas and Electric Company and will give an idea of the scale of production attempted. The roof of this booth was formed of cut tissue paper hung as closely as possible and illuminated with hundreds of tungsten lamps. A corps of attendants was in waiting to explain the use, price, cost of operation, etc., of the various appliances, rather than to sell them, this part being attended to at the company's sales room on South Main Street. The display was in charge of the Sales Department of the Company of which Malcolm A. Smith is manager, and from an advertising standpoint, was quite a success.

The Effect of Electric Currents on Concrete.[1]

During the last few years attention has been called to the possibility of damage to reinforced concrete structures by stray currents from electric railways and other power sources. The laboratory experiments of Toch, Knudson and Langsdorf, in 1906 and 1907, showed quite clearly that under certain circumstances the passage of electric current from the reinforcing material out into the concrete gave rise not only to serious corrosion of the reinforcing material, but also to cracking and disintegration of the surrounding concrete. Since then numerous laboratory experiments have been carried out by various investigators, all tending to confirm the earlier observations in regard to the destruction of the concrete, but giving rise to numerous conflicting theories as to the cause of the phenomena observed.

Following the early demonstrations of the possibility of damage to concrete by electric current, reports of serious damage to certain concrete buildings, bridges, etc., have been circulated and considerable apprehension has been aroused that great damage may be due to this cause. Recognizing the great practical importance of the subject, and acting in response to requests from numerous sources, the Bureau of Standards has been conducting a thorough investigation of the cause and extent of damage to concrete by electric current and the best methods of mitigating the trouble under practical conditions.

The investigation has been conducted along the following lines:

(1) Laboratory studies of the cause and nature of the phenomena caused by the passage of electric currents through concrete.

(2) Observation in the field with the view of establishing definitely the probable extent of the danger in practice and the circumstances under which trouble is most likely to occur.

(3) A study of the various possible means of mitigating trouble from this source, leading to specific recommendations based thereon.

The reports of previous investigators that the passage of current from an iron anode into normal concrete caused destruction by cracking were only partly confirmed. This effect did not occur in most of the specimens tested when the potential gradient was less than about 60 volts per foot.

Among the numerous theories that have been advanced for the cracking, the one which attributes it to oxidation of the iron anode following electrolytic corrosion has been fully established. The oxides formed occupy 2.2 times as great a volume as the original iron, and the pressure resulting from this increase of volume causes the block to crack open. The mechanical pressure developed at the iron anode surface by corrosion of the iron has been found to reach values as

1 Abstract of paper presented at meeting of National Association of Cement Users by E. B. Rosa, Burton McCollum and O. S. Peters

high as 4,700 pounds per square inch, a value more than sufficient to account for the observed phenomena of cracking. Metals which do not form insoluble products of corrosion and all non-corrodable anodes never cause cracking of the concrete as a result of the passage of an electric current.

Suggestions of some engineers that copper-coated steel, or aluminum, be used as reinforcing material have been shown to be impracticable, since the copper coating is readily destroyed and the aluminum is attacked by the alkali in the concrete.

The corrosion of iron anodes in normal concrete is very slight at temperatures below about 50 degrees centigrade. The lack of corrosion of the iron at temperatures below 50 degrees is due to the inhibiting effect of the hydrated lime in the concrete. For any fixed temperature the amount of corrosion for a given number of ampere-hours is independent of the current strength.

The rapid destruction of anode specimens at from 60 to 100 volts is made possible mainly by the heating effect of the current, which raises the temperature above the limit mentioned above. If the specimen be artificially cooled no appreciable corrosion occurs and no cracking results.

In the specimen tested, the potential gradient necessary to produce a temperature rise to 50 degrees centigrade, with consequent corrosion, was about 60 volts per foot. For air-dried concrete it is much higher. This shows that under actual conditions corrosion from stray currents may be expected only under special or extreme conditions.

Since the passivity of iron in concrete is due chiefly to the calcium hydrate present, it appears probable that old structures, in which the hydrate has been largely converted into the carbonate, will be more susceptible to the effect of electric current than the comparatively new concrete with which the foregoing experiments have been made. The increase in the corrosion would, however, be partly offset by the increase in the resistance of the older concrete.

The addition of a small amount of salt to concrete, as is frequently made to prevent freezing while setting, has a twofold effect. First, it greatly increases the initial conductivity of the concrete, thus allowing more current to flow, and, second, it destroys the passive condition of the iron at ordinary temperatures, thus multiplying by many hundreds the rate of corrosion and consequent deterioration of the concrete. Salt should, therefore, never be used in structures that may be subjected to electrolytic action. Further, reinforced-concrete structures built in contact with sea water or in salt marshes are very susceptible to trouble from electrolysis.

Specimens of normal concrete carrying currents increase their resistance a hundredfold or more in the course of a few weeks, which fact still further lessens danger of trouble. The rise of resistance is in general due to the precipitation of calcium carbonate within the pores of the concrete, thus plugging them up. A slight amount of salt prevents this precipitation and consequent rise of resistance, thus still further emphasizing the detrimental effect of the presence of salt.

Contrary to the observations of previous investigators,* a distinct softening of the concrete near the cathode was observed. This begins at the cathode surface and slowly spreads outward, in some cases one-fourth inch or more. After exposures to the air this softened layer becomes very hard again, but remains brittle and friable. This softening effect causes practically complete destruction of the bond between the reinforcing material and the concrete, reducing it to a few per cent of its normal value. Unlike the anode effect, which becomes serious in normal concrete only on comparatively high voltages, the cathode effect developes at all voltages, the rate being roughly proportional to the voltage in a given specimen. For this reason it may frequently occur in practice, and is therefore a more serious matter practically than the anode effect about which so much has been heard.

The softening of the concrete at the cathode is due chiefly to the gradual concentration of sodium and potassium near the cathode by the passage of electric current. The alkali in time becomes sufficiently strong to attack the cement. This action can be increased or diminished by varying the sodium and potassium content of the cement.

Observations have shown that the softening of the concrete only takes place very close to the cathode, the main body of the concrete remaining perfectly sound without loss of strength. Because of this effect the method of protecting reinforced-concrete buildings by connecting the reinforcing material as a cathode to a battery or booster would be much more dangerous than no protection at all.

The only effect which an electric current has on non-reinforced-concrete is to cause a migration of the soluble elements. Consequently, in the absence of electrodes, the ultimate effect of current flow on the physical properties of the concrete is not materially different from that of water seepage, which also removes the soluble elements. Non-reinforced-concrete buildings are therefore immune from trouble due to stray earth currents.

Waterproofing reinforced concrete would greatly increase its resistance and diminish accordingly the danger from the anode or cathode effects. Waterproofing to prevent electrolysis is a much more difficult matter than waterproofing to maintain a moderate degree of dryness, because of the much higher degree of waterproofing required in the former case. It has been found that practically all of the waterproofing agents now on the market that are intended to be mixed with the concrete are of little value as preventives of electrolysis. Waterproofing membranes, however, when applied to the surface, can be made more effective and may have considerable effect in preventing the entry of earth currents.

Painting or otherwise coating iron with an alkali-resisting metal preservative before embedding it in concrete may serve to minimize the dangers of electrolysis, but no such coating has been found that does not prevent the formation of the bond between the concrete and iron when the concrete sets. In order to insure safety from electrolysis, potential gradients must be kept much lower in structures exposed to the action of salt waters, pickling baths and all solutions of chlorides, sulphates, nitrates or carbonates.

All electric power circuits within the building should be kept free from grounds directly on a portion of the building itself. If the power supply comes from a central station the local circuits should be periodically disconnected and tested for grounds and incipient defects in the insulation. In isolated plants ground detectors should be installed and the system kept free from grounds at all times.

All pipe lines entering concrete buildings should, if possible, be provided with insulating joints outside the building. If a pipe line passes through a building and continues beyond, one or more insulating joints should be placed on both sides of the building. If the potential drop around the insulated section is 8 or 10 volts or more, the insulated portion should be shunted by means of a copper cable. The grounding of electric conduits to water pipes and ground plates is in general not to be recommended in the case of concrete structures.

Lead-covered cables entering such buildings should be insulated from the concrete. Wooden or other non-metallic supports which prevent actual contact between the cable and the concrete will give sufficient insulation for this purpose. Such insulation of the lead-covered cable is desirable for the protection of the cable as well as the building.

In making a diagnosis of the cause of damage in any particular case, the fact that a fairly large voltage reading may be obtained somewhere about the structure should not be taken as sufficient evidence that the trouble is due to electrolysis. The distance between the points, and particularly the character of the intervening medium, are of much greater importance than the mere magnitude of the voltage reading. As a precautionary measure, however, all potential readings about a reinforced-concrete structure should be kept as low as possible.

Tests of "Yellow" and "Red Fir" Cross-Arms.

We are indebted to E. L. Barnes, president and general manager of the Barnes-Lindsley Manufacturing Company, Portland, Ore., for the following interesting data respecting tests recently made on "Yellow" and "Red Fir" cross-arms.

The United States Forest Service says the following regarding the color of the wood in Bulletin No. 88: "Douglas Fir varies in color from a decided reddish tinge to a light yellow and on this account is sometimes classified as Red and Yellow Fir. The Red Fir, as a rule, has a coarses grain and contains a considerable amount of the dark-colored summerwood. It is usually obtained from second growth timber or from the heart of older trees. Yellow Fir is the soft, fine-grained wood obtained from the outer portion of mature trees. It yields a large proportion of clear lumber. The difference in color is supposed to be due mainly to the difference in the rate of growth."

The Forest Service made a number of tests of the comparative strength of the two species, the results of which are carried in the above mentioned bulletin. Copies of this may be obtained from the Service at Washington, D. C., on request.

These tests show (in the words of the bulletin): "On the basis of all grades the difference in favor of the Red Fir varies from 2 to 4 per cent." In a test on pieces of high-grade wood (the kind used for cross-arms) the modulus of rupture of the Yellow Fir was 6,773 pounds, as against 7,400 pounds for the Red, while the moduli of elasticity were respectively 1,871,000 and 2,106,000 pounds per square inch. On the low grades the difference was slightly in favor of the Yellow Fir, but none of the low-grade lumber is used in the manufacture of arms.

The Barnes-Lindsley Manufacturing Company recently made some tests on a home-made testing machine at its plant on the Columbia River, which showed that the Red Fir average from 10 to 14 rings per inch was much stronger than the Yellow Fir with the closer grain. The tests were made as shown in the illustrations, a Yellow and a Red Fir arm being crossed as shown, and the strain applied by means of the windlass. There was no way of telling the amount of strain needed to break the arms, as a dynamometer could not be secured. Each arm was 62 inches long.

The tests resulted as follows:

Test No.		Rings per inch.	Size.	
1	Yellow	15 to 20	2¾x3¾	Broke
	Red	10 to 12	2¾x3¾	
2	Yellow	12 to 15	2¾x3¾	Broke
	Red	7 to 10	2¾x3¾	
3	Yellow	14 to 20	2¾x3¾	Broke
	Red	8 to 12	2¾x3¾	
4	Yellow	13 to 18	2¾x3¾	
	Red	9 to 12	2¾x3¾	Broke
5	Yellow	15 to 21	2¾x3¾	Broke
	Red	7 to 9	2¾x3¾	
6	Yellow	16 to 20	2¾x3¾	
	Red	6	2¾x3¾	Broke
7	Yellow	14 to 20	3 x4¼	Broke
	Red	12 to 15	2¾x3¾	

Test No. 7 is of particular interest, as the Yellow Fir arm had a cross-section 2.44 square inches larger than the Red, yet failed to withstand the strain.

Two Views of Methods Adopted in Conducting Tests on Cross-Arms.

Telephone Standards in Wisconsin.

In an address before the Wisconsin State Telephone Association, J. N. Cadby, engineer of the Railroad Commission, outlined a new scheme of obtaining efficient telephone systems. He favors the establishment of a definite standard of telephone service by the Commission, to which private systems can be compared. He said in part:

"Inspectors in the service of the Railroad Commission have been conducting an investigation throughout the state by noticing the amount of time which was taken in securing calls and responses from operators. From the data thus obtained, schedules have been arranged.

"It was found that the opinions of the inspectors differed and that there was no uniform standard by which the efficiency of service could be compared. In the opinion of the inspector, the service might be considered good, while in the opinion of the office man who received the report it might be considered bad, or vice versa.

"The Commission plans to adopt, after a hearing with the telephone companies, a code of rules for the operation of telephone systems in the state which will remove many of the objectionable features existing under the present system of operation."

Point Fives Adopt Slogan.

The Point Fives, an association of British central-station managers, has adopted the Jovian slogan "All together, all the time, for everything electrical." The chief requirement for eligibility consists in making a rate for domestic purposes (cooking, heating, etc.) not greater than one cent (0.5 penny) per kilowatt-hour, with or without a demand charge. There are now ten members, that being the number of central stations in England which make the required rate. These are located at Barnes, Bradford, Carlisle, Luton, Poplar, Reading, St. Marylebone, Southampton, Sunderland and York.

Niagara Falls Power Bill.

At a conference between Secretary of War Stimson and the House Foreign Affairs Committee it was decided to postpone all legislation for the control of power companies operating at Niagara Falls. Mr. Stimson indorsed the Cline bill, but owing to the congested condition of business in the House, the committee decided it would be unwise to press the bill at this session. Mr. Stimson advised that the Burton law, which expires March 4, be extended. The extension probably will be granted, pending further action on the bill.

New Electrical and Mechanical Appliances

Successful Motor-Operated Railroad Lift Bridges.

Practically all the railroad lift or draw bridges erected in the last few years where electric power is available, are motor operated. That motor drive is being adopted for this purpose is a significant fact because railroad bridges must be absolutely reliable in operation. Experience has proved that motors are fully as reliable as any other form of drive. They are more economical, as there is no maintenance expense when the bridge is not being operated. The control of motors is far simpler than that of any other form of drive, and many protective devices can be installed.

The two interesting installations of motor-operated railroad bridges are those that carry the six tracks of the Harlem River branch of the New York, New Haven & Hartford Railroad over the Bronx and the Hutchinson Rivers and over which approximately 200 trains pass daily. These bridges have been in successful operation now for several years and afford an excellent example of the reliability of electric drive.

Each bridge is made up of three leaves; each leaf carries two of the six tracks. The Bronx River bridge is near the Westchester Avenue station; the Hutchinson River bridge is between the Baychester and Bartow stations. Both are Scherzer type rolling-lift bridges.

Since the channels spanned by these bridges are only about 100 feet wide, the rolling-lift construction was adopted, because this type requires no center pier and involves no obstruction or widening of the channel. Fig. 1 shows the three leaves of the Bronx River bridge open, and Fig. 2 a closer view of the "ways" upon which one leaf rolls; the other bridge is similar in construction. The number of daily openings varies, averaging five in the case of the first bridge during winter months and twelve during other months.

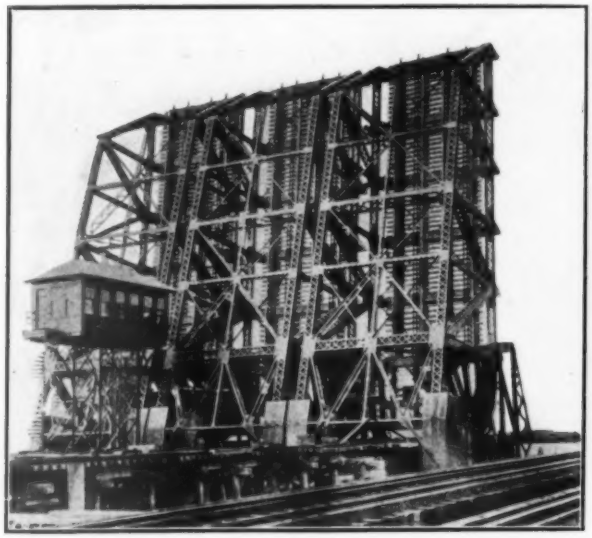


Fig. 1.—Rolling-Lift Railroad Bridge Over the Bronx River.

Fig. 2.—Rolling Member and Roll-Way of Bridge.

Each leaf is operated by two Westinghouse 25-horsepower, 550-volt, direct-current motors mounted on the moving leaf and geared to pinions which project from the side and mesh with racks on the stationary part of the bridge. Under ordinary circumstances the two motors on each leaf are operated together as one unit, but either can be controlled separately and either has sufficient capacity to move its leaf, although of course more slowly than if the two motors are working together. Both motors are provided with an electric brake and each leaf has a separate emergency brake.

The motors, brakes, and other apparatus on the bridge itself are weatherproof, and designed for successful operation through an angle of 90 degrees, through which angle the bridge moves. The conduit carrying the current to the moving part of the bridge can be seen near the lower left hand side of Fig. 2, passing to the upper side of the roll-way and (when the bridge is open, as shown) lying along a trench to the point where the conduit is carried up into the bridge itself. As the bridge swings down, the point where the cables enter the leaf moves upward, and the slack cable rises out of the trench.

The bridge is controlled from a tower. To open the bridge the signals are first set against trains, derails are opened, and bridge rail-lock mechanisms are released. Until these steps are taken, it is impossible to open the bridge. The controllers are then operated and the upward movement of the bridge begins. At four points in its travels, signal lamps are lighted and bells are rung. If the power is not shut off when the leaves are at the proper height, a circuit-breaker is tripped automatically. When the bridge is open, the navigation lights on the river change from red to green.

The leaves are arranged so that in case of emergency they may be manually operated by means of an endless

chain over a wheel on the countershaft. Considerable time is required for this and it has never been necessary since either of the bridges were put into service.

The motors and complete electrical equipment for this bridge were furnished and installed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

The Five Largest Electrical Manufacturers in the World.

An interesting financial comparison of the five largest electrical manufacturing companies in the world was given in a recent issue of *The Wall Street Journal*, of New York City. This is based on the latest figures available, those for the fiscal years ending (according to the company), between December 31, 1911, and March 31, 1912. These companies, given in the order of precedence according to the gross business done for the year in question, are: Allgemeine Elektricitäts, Gesellschaft, Berlin, Germany; General Electric Company, Schenectady, N. Y.; Western Electric Company, New York and Chicago; Siemens & Halske Aktiengesellschaft, Berlin, Germany; Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

The table herewith gives in condensed form a comparative statement of the organization, business and earnings of the five companies. The last two columns are obtained by considering the capital and surplus as the total investment of the stockholders and finding the relation to this of the net earnings, after interest has been deducted. In connection with the figures for the Westinghouse Company, it must be remembered that its financial difficulties and receivership of 1907 have had an important influence on its subsequent reorganization and performance.

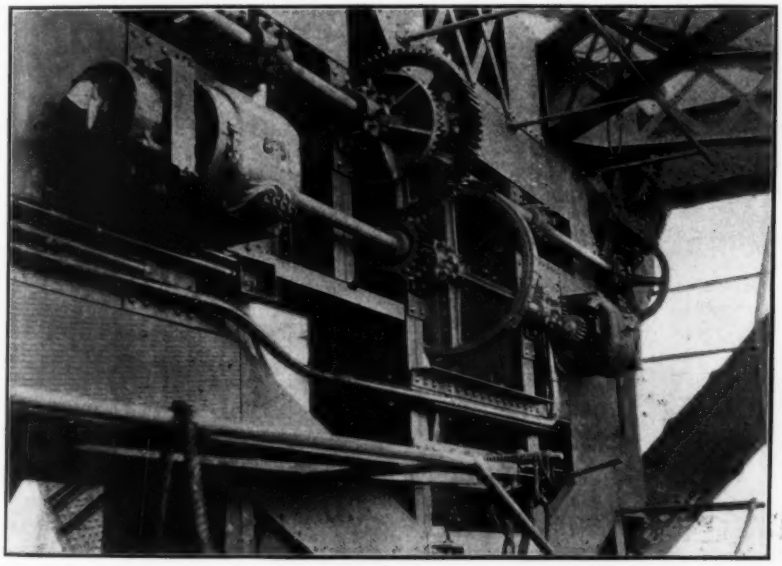


Fig. 3.—Motors and Driving Gear of Bridge.

Company	Gross Sales	Capital Stock	Interest-Bearing Debt	Surplus and Reserves	Total Net Investment
Allgemeine Elektricitäts	$86,000,000	$30,940,000	$19,459,000	$18,736,000	$ 69,135,000
General Electric	70,384,000	77,335,000	2,806,000	29,020,000	109,161,000
Western Electric	66,211,000	15,000,000	15,091,000	23,073,000	53,164,000
Siemens & Halske	66,000,000	14,994,000	11,077,000	6,644,000	32,715,000
Westinghouse Elec. & Mfg.	34,196,000	40,699,000	29,547,000	6,649,000	76,895,000

Company	Relation of Sales to net Investment	Net Earnings Before Deducting Interest	Earned on Net Investment	Capital and Surplus	Net Earnings, Less Interest	Earned on Stockholders' Investment
Allgemeine Elektricitäts	124%	$ 6,751,000	9.8%	$ 49,676,000	$ 5,651,000	11.4%
General Electric	64	10,934,000	10.0	106,355,000	10,563,000	9.9
Western Electric	124	4,135,000	7.8	38,073,000	3,280,000	8.6
Siemens & Halske	202	3,003,000	9.2	21,638,000	2,695,000	12.4
Westinghouse Elec. & Mfg.	45	3,006,000	3.9	47,348,000	1,317,000	2.8

Wireless-Telegraph Devices in Brazil.

The Brazilian Government has concluded an important contract with Marconi's Wireless Telegraph Company for the provision of powerful stations at Rio de Janeiro, Santa Martha, Bauru, and Ladario, the two last named being important towns in the Sao Paulo and Matto Grosso regions. These stations will form the southern part of the Brazilian internal wireless network first proposed by Dr. Bhering.

Radical Improvements in Fuse Plugs.

The new fuse plug made by the H. T. Paiste Company, of Philadelphia, Pa., marks a radical step in fuse-plug manufacture. With the old-style fuse plug the entire plug must be thrown away when the fuse blows. With the New Paiste fuse plugs only the fuse core, called Fusette, is lost and a large part of fuse-plug expense is saved.

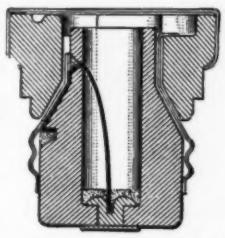
The Paiste fuse plug is in two separate parts, a permanent mica-cap holder with

Holder for Paiste Fuse Plug.

brass screw-shell and a removable porcelain core, the Fusette, containing the fuse. When the fuse blows the old Fusette is taken out and a new one slipped into the holder. In the Fusette, one end of the fuse strip is soldered to the bottom contact rivet; it is then carried up

Paiste Fusette.

through the hollow center of the porcelain and out through the side, bent over, and the outside end cemented fast. When the Fusette is slipped into the holder and screwed into a cutout, the outside part of fuse strip is forced tight against



Section Through Complete Plug.

the brass sleeve of the holder and completes the circuit, the wide fuse strip insuring a good contact.

No care is needed when inserting the Fusette into the holder as the contact is made in any position, and the entire construction is so simple that special instruction in handling is unnecessary. The

plugs are of standard size so that no additional expense is required in changing from the plugs now in use, the new-style plugs being substituted as quickly as the old-style are blown out.

Paiste fuse plugs are approved for all circuits up to 125 volts and the laboratory tests of them give a splendid record for safely and accuracy.

A Permanent Exhibit of Telephone Apparatus.

The telephone, though only slightly over 37 years of age, has probably developed more in that short time than most of its humanity-helping contemporaries. In fact, writers have termed the development of the telephone a "romance of science." The story of this romance has been put forward in what is perhaps the most understandable and, at the same time, the most interesting way, in the exhibit of historical and modern telephone apparatus and electrical supplies recently inaugurated at New York City by the Western Electric Company. The exhibit is in three sections.

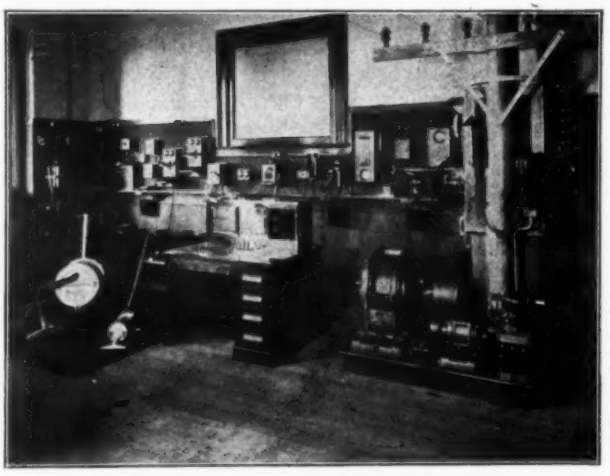
Western Electric Company's Exhibit of Telephone Apparatus.

The historical section shows the development of the telephone from its earliest stages up to the present time. The smoked-glass records of sound waves made by Alexander Graham Bell in 1874, using the human ear as a transmitting diaphragm and thus proving that diaphragms would transmit sound waves, parts of Bell's original telephone of 1876, mounted to make a complete model, and numerous instruments showing the gradual improvement in design, are exhibited to great advantage in large glass cabinets with placards giving a description of each article. Included in the historical collection, which is composed partly of apparatus loaned by the American Telephone & Telegraph Company and partly of Western Electric apparatus, are the switchboard used by Mr. Bell in opening the New York-Chicago line in 1892, and the receivers and transmitters used at the opening of the New York-Denver line in 1911.

The modern-apparatus section contains switchboards, magneto and central battery, each switchboard having wired to it a number of telephone sets, so that service demonstrations may be made to visitors. In this way the exhibit room serves the double purpose of an interesting and instructive exhibit and a room in which actual apparatus under actual working conditions may be shown.

In another part of the exhibit room every system of inter-communicating telephones is represented, and there is also a complete line of representative telephone train-dispatching apparatus in operative condition. Samples of telephone apparatus and cable manufactured by the foreign houses of the company, at London, Antwerp, Paris, and Tokyo, are shown.

Miscellaneous telephone apparatus, such as combined jacks and signals, keys, lamps, lamp sockets, jacks, cords, plugs,



Another Portion of the Exhibit.

and repeating coils, as well as representative pieces of telegraph apparatus, are exhibited in a large glass show case.

In other show cases are samples of all the various supply lines manufactured and distributed by the company. These include electric household goods of all kinds, such as Western Electric-Sturtevant vacuum cleaners, sewing-machine motors, electric heating devices, lamps, flashlights and bells. In another show case are to be found electric light devices and accessories, such as Mazda lamps, sockets an dswitches. Electrose and porcelain high and low-tension insulators are also given a prominent place.

The exhibit room is located at the Western Electric Company's New York offices, 463 West Street. It is open to visitors from 8:30 a. m. until 3:15 p. m.

Resistance of Tungsten at High Temperature.

Experiments have been made by Pirani upon the resistance of tungsten at high temperatures and published in the *Physikalische Zeitschrift*. He made use of a ribbon of tungsten 60 millimeters long, 1.25 millimeters wide and 0.05 millimeters thick, mounted in the bulb of an incandescent lamp. To this ribbon two very fine wires were soldered to serve for the measurement of resistance. This precaution was necessary in order to eliminate the effect of the supports and to permit of making measurements upon that portion of the filament where the radiation is uniform. This condition is never realized in an ordinary incandescent lamp, where the electrodes and support may interfere with the measurements. The ribbon was bent in such a manner as to form a cavity somewhat similar to the typical "black body." The measurements of temperature were made with the aid of a Holborn-Kurlbaum pyrometer, using a red glass of wave-length 0.64 micron. Corrections were then necessary for the absorption of this glass.

Measurements of resistance were made at temperatures from 1,200 to 2,000 degrees centigrade. The ratio of the resistance to the resistance at room temperature (20 degrees) was found to be 7 for 1,200 degrees; 10 for 1,600 degrees, and 12 for 1,900 degrees.

The absorptive power of incandescent tungsten was also computed from these experiments and found to be as follows:

For the wave-length 0.64 micron equal to 0.485 at a temperature of approximately 1,750 degrees centigrade.

McGill Lamp Guards.

A very complete line of lamp guards has been placed on the market by the McGill Manufacturing Company, Valparaiso, Ind. Included in this are not only lamp guard cages that can be attached to practically any socket, but also combination guards and reflectors, guards and locks, and a variety of portable lamp guards and trouble finders. Space permits mentioning only a few of the new but typical designs.

A convenient set of guards with reflector tops is that known by the McGill trade name "Gripson." Three of these are shown in the first three illustrations herewith. In each case the

Fig. 1.—Gripson Guard with Reflecting Top.

frame is made of strong steel wire with electrically welded joints, thus giving an exceptionally durable cage. The cage has two protruding handles at the top edge; pressing these handles expands the upper spring wire ring so it may be easily slipped into the outer groove about the metal top which it strongly grips. This metal top can be quickly fastened to any standard brass-shell socket without resort to tools.

Fig. 1 shows the Gripson guard with

Fig. 2.—Gripson Guard with Deep Cone Shade.

a plain reflecting top, the latter being made of strong steel brightly tinned and polished inside to act as a reflector. Fig. 2 shows the Gripson guard with deep cone shade, particularly adapted to low-hanging lamps. The reflector has an enameled-green outer finish and aluminum-bronze inside finish. Its diameter is 10 inches and it acts to throw the light, which otherwise would be wasted upward, into useful directions upon the work. The Gripson guard shown in Fig. 3 has a flat cone reflector specially adapted to lamps hanging high or where there is a dark ceiling. This reflector has the same diameter and finish as the deep cone shade.

In erecting shops, assembling rooms, repair shops, engine and boiler rooms, garages, etc., it is generally necessary to have a number of extension cords

Fig. 3.—Gripson Guard with Flat Cone Shade.

equipped with conveniently portable and protected inspection lamps. For this purpose the McGill Manufacturing Company makes a variety of portable lamp guards, two of which will be described. Fig. 4 shows a device of this kind which is extremely simple and rugged in construction. The handle and socket-holder are in one piece

Fig. 4.—Portable Lamp Guard.

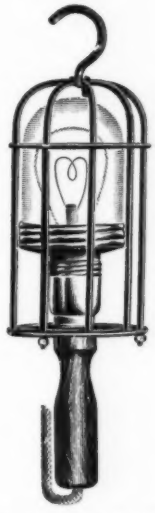


Fig. 5.—Vapor-Proof Lamp Guard.

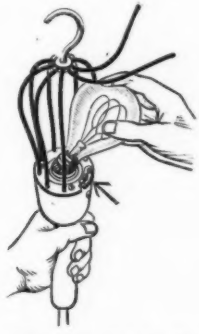


Fig. 6.—Renewing Lamp for Guard Shown in Fig. 4.

with the socket countersunk therein. A keyed or keyless socket is supplied as desired. The cage is strongly made and is also a unit structure secured to a ring at the end of the socket-holder. At one side of this ring is a sliding ratchet fastened with a set screw whose release permits two of the ribs to be turned out so that the lamp can be easily replaced as shown in Fig. 6. The entire device is light and strong.

In gas works, packing houses, breweries, tanneries and other places where gas vapor or dampness abounds, there is demand for a portable light free from all danger from sparks or short-circuits. For this purpose the vapor-proof portable lamp shown in Fig. 5 has been developed. Surrounding the lamp is a separate glass dome screwed into a shell closely fitting the socket. The hook on the guard is a convenient means for hanging the lamp when both hands are engaged.

Revolving Field of Alternating Current Mechanically Illustrated.

The Fairbanks-Morse Current'o Scope shows in a simple and correct manner, how the so-called revolving field is produced by the action of alternating currents in a three-phase alternating-current induction motor.

A three-phase alternating current is really three alternating currents usually flowing in three wires, the reversals following each other in the three wires at equal intervals of time, always in the same order.

In the center of the Current'o Scope there will be seen through the two circular openings, three radial lines which represent the relative direction and strength of the electric currents in phases 1, 2 and 3 of a three-phase generator, or transmission line, or motor. For convenience, we will refer to them as black, green and red phases. When a line appears in the upper circle it indicates a current in the positive direction in that phase and a line in the lower circle indicates a current in the negative direction. The length of the lines as they show through the circular holes indicates the instantaneous strength of the current.

Turn the disk until the black line points vertically upward in the upper circle; this represents a current of maximum value flowing in the positive direction in the black phase.

Turn the disk opposite to the motions of the hands of a clock, and notice that the black current decreases gradually, becomes zero, then reverses and starts in the negative direction, as shown by the appearance of the black line in the lower circle, gradually increases to its maximum negative value when the black line is vertical, decreases again to zero, changes to positive and gradually increases until it reaches its maximum positive value again when the black line is vertical. The red and green lines will

be seen to pass through similar changes, following each other one-third of a revolution apart.

Again adjust the disk until the black line points vertically upward in the upper circle; the black current is now at its maximum value in the positive direction and the green and red currents are exactly half of the black current, in the negative direction. This may be looked upon as a current flowing inward through the black phase and dividing into two equal parts which return outward through the green and red phases.

Turn the disk as before and note that the black current decreases, the green current increases and the red current decreases. After moving the disk 30 degrees, it will be noticed that the decreasing black current and the increasing green current have reached the same value and the red current has disappeared. At this time there is no current in the red phase and all the current is flowing in through the black phase and out through the green.

Turn the disk still farther and the black current will go on decreasing while the green current increases, until, after moving 30 degrees, the green line extends vertically downward, indicating that the green current has reached its maxium value in the negative direction, while the red current has reversed and is now flowing in the positive direction, as shown by the red line in the upper circle, and the red and black positive currents are each equal to one-half of the green negative current. This condition may be looked upon as two equal currents flowing in through the red and black phases and joining together to flow out through the green phase.

The outer part of the diagram shows the frame, core and windings of a two-pole three-phase induction motor; the pale green slotted ring represents the stator core and the red, green and black spots represent the wires in the stator slots; the red, green and black lines running around the core from the left foot of the motor indicate the lead wires through which the current flows to these windings and the other ends of the three windings may be assumed to be all joined together at the back of the motor. In a star-wound motor they actually are joined.

The arrows which appear through the slots in the motor foot indicate the direction of the currents in the lead wires, while the spots and crosses which appear through the round holes in the stator frame indicate the direction of the currents in the phase windings opposite which they appear, the crosses indicating a current flowing downward or away from the observer and the points indicating currents flowing upward or toward the observer. Where a zero appears in these holes, it indicates no current in that phase. The red and black shaded portions of the disk which show through the inner rectangular slots indicate the strength and direction of the magnetic field produced by the combination of the currents flowing in the different phases, the red indicating a north pole and the black a south pole. The more deeply shaded portions where the letters N and S appear, indicate the points of maxium field strength, and the lightly shaded portions indicate the gradual weakening of the field on either of these points.

Placing the disk with the black line extending vertically upward through the opening at the center of the diagram and looking at the arrows through the openings in the motor foot, we see that the black current is flowing inward to the upper part of the black phase windings and from there downward to the back of the motor, where it passes through the end connections of the coils to the opposite windings of the black phase at the bottom of the diagram. After passing through all the windings of the black phase to the point where the three phase windings are joined together, it splits into two equal currents which flow outward through the red and green phases, passing downward through that part of these windings which lies above the horizontal line and upward through the parts lying below the horizontal line, as shown by the crosses and points back of the round openings.

Current 'o Scope for Showing Revolving Field.

In all the wires below a horizontal line through the center of the diagram, the points that show through the openings in the stator core indicate that the current is coming upward toward the observer, and above a horizontal line the crosses indicate that the current is going downward away from the observer. This is equivalent to right-hand rotation of the current about the central part of the left-hand inner surface of the stator core and consequently produces a south pole at that point, while looking at the opposite or right-hand surface the direction of rotation of the current would be left-hand and consequently a north pole would be produced at that point. The strength of the current in the black phase is at its maximum value and the strength of the current in the red and green windings is equal; therefore, the total current strength above and below the horizontal line is the same and the poles or points of maximum field strength are located at the ends of the horizontal line.

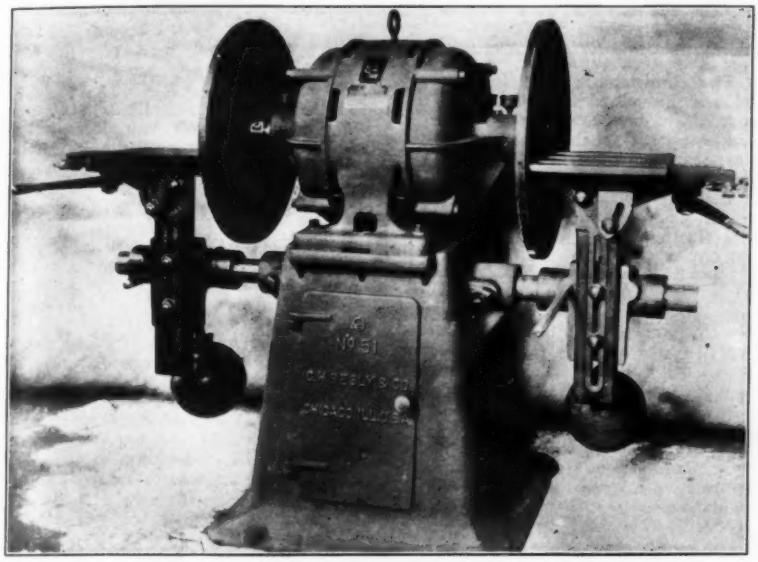
Turning the disk until the next series of marks appears through the openings, we see that the currents are all in the same direction as before, but the green current has increased in strength a little and the red current has decreased in strength a little, so that the total current strength is no longer symmetrical about a horizontal line but the green current in the windings above the line have strengthened and the red currents have weakened and below the line the red windings at the left have weakened while the green windings have strengthened, thus shifting the poles downward at the left and upward at the right.

As the disk is farther turned step by step, it will be noticed that these changes are repeated and that the poles are shifted continuously in the same direction, until when the black line is projecting vertically downward showing that the black current has reached its maximum value in the negative direction, the poles have made one-half of a revolution and the north pole is now at the left where the south pole was located when we started, and upon turning the disk until the black line projects vertically upward again completing one cycle for the current, it will be found that the poles have made one complete revolution, that is, for a two-pole machine the revolving field makes one complete revolution for each cycle. For four-pole machine there would be four poles about the circumference of the core instead of two and the revolving field would advance from the initial position of one north pole to the initial position of another north pole.

The rotor or revolving part of an induction motor, made up of an iron core and a number of copper bars or group of coils, is dragged around by the revolving field exactly as a two-pole magnet mounted upon the shaft would be, except that it lags slightly behind the speed of the revolving field by an amount corresponding to the load on the motor.

Motor-Driven Disk Grinder.

The accompanying illustration shows a motor-driven lever-feed disk grinder recently placed on the market by C. H. Besly & Company, at Chicago, Ill. The scope of this machine's work is almost phenomenal. The improvement made on the older type of grinder by the addition of a geared lever-feed table and electric-motor drive makes it essentially a manufacturing tool, designed for use in nearly all lines of manufacture for making, perfecting and finishing flat surfaces of metal, wood, and other material. It may be operated by unskilled labor, and work to which it is adapted is done in a fraction of the time required by a lathe, planer, shaper, miller, file or other types of surface grinders.



Motor-Driven Disk Grinder.

Grinding is done by emery or other abrasive cloth sheets, called circles, glued to the faces of steel disk wheels, which are usually 12 to 53 inches in diameter, according to the size of the piece to be ground, and of suitable thickness to withstand the stresses and requirements met with in actual service. The disk wheel is made of wrought steel, specially treated to eliminate strains in the metal. It is machined with great care and runs "dead true" in perfect balance at a considerably higher speed than is practicable with the ordinary solid emery wheel. When "circles" become worn, they may be removed from the wheels and new ones cemented and pressed on. The speed at which the abrasive travels varies. On the softer metals, 7,500 feet, and on the harder material, 6,500 feet a minute are the average speeds used.

Exhaustive tests covering a variety of disk-grinder work show that the total amount of feeding pressure exerted in rough grinding different work varies from a few pounds up to 800 pounds. In exceptional cases, a feeding pressure of 100 pounds a square inch of ground surface area can be used without destructive effect on the circle.

The work to be ground is laid on the face of the disk wheel and the grinding is done by means of the lever feed. By the use of the adjustable table, work may be held in any desirable position and forced against the abrading disk by a hand lever with sufficient pressure to secure full efficiency of machine and circle, without undue exertion on the part of the workman. The lever - feed table provides sufficient feeding pressure to rough grind quickly, and has angular adjustments and micrometer stop screws, so that work may be ground accurately to required angles and sizes.

This work table made it necessary to provide additional driving power and improved means for receiving the heavy end thrust on the spindle, consequently motor-drive was selected. The grinder is driven by a 15-horsepower Westinghouse motor. It has extra heavy thrust bearings, brackets and shaft. The windings are well braced.

Demand for Electric Pocket Lamps in Turkey.

On account of the very unsatisfactory street lighting in many Turkish cities the people are accustomed to carrying lamps or lanterns. Electric pocket lamps complete with dry cells have recently come into vogue among all but the very poor and their popularity is rapidly growing. In Trebizond, a city of about 55,000, there were sold last year about $5,000 worth of such outfits, mostly of German make.

Completed Line of Watson Polyphase Motors.

The Mechanical Appliance Company, Milwaukee, Wis., has filled out its line of Watson polyphase motors in standard sizes up to 45 horsepower. As with the Watson direct-current motors, the company has adhered to its policy of concentrating on the building of motors of small and moderate capacities, such sizes as are used in the large majority of motor applications of the present day. The accompanying illustration shows one of the polyphase motors of the squirrel-cage type. Air is forced through the coils of the stator by the fan action of the motor, tending to lower their temperature and increase the overload capacity. The form-wound coils are protected from the core punchings at the ends by fibre sheets, and after assembling are immersed in an insulating and moisture-repellant compound.

Watson Polyphase Motor.

The bearings, shaft, etc., have been designed along lines proven correct in the direct-current Watson motors.

For special direct-driven machines requiring extra high speed, as vacuum cleaners, etc., a 3,600-revolution-per-minute alternating-current motor is standardized. In this type every precaution has been taken in the design and manufacture to insure a perfectly balanced rotor, so necessary for high-speed work.

Latest Approved Fittings

CABINETS.—United Sheet Metal Works, 575 Howard Street, San Francisco, Cal.
Approved December 31, 1912.
Wheeler-Green Electric Company, 71-75 St. Paul Street, Rochester, N. Y.
Approved December 31, 1912.
Mesker & Brother, St. Louis, Mo.
Approved January 7, 1913.

CABLES, Armored.—Trenton Electric & Conduit Company, Trenton, N. J.
Approved December 20, 1912.

CONDUIT BOXES.—The McKinley Outlet Box Holder Company, 1012 Froost Avenue, Kansas City, Mo.
Stamped-steel supports perforated with slots and holes for mounting screws for convenience in adjusting and securing outlet boxes in ceilings in the position desired.
Approved December 28, 1912.

CONDUIT, RIGID. — Greenfield Conduit Company, Limited, 70 West King Street, Toronto, Canada.
"Greenfielduct."
Approved January 13, 1913.

Fig. 1.—Flush Receptacle (Catalog No. 7612).—Cutler-Hammer Manufacturing Company.

CONDUIT OUTLET PLATES. — Sprague Electric Works of the General Electric Company, 537 West Thirty-fourth Street, New York, N. Y.
Catalog Nos. 6348 and 6349.
Stamped steel plates 2.5 inches in diameter, with one and two half-inch knockouts, respectively.
Approved December 20, 1912.

FLEXIBLE CORD.—Imperial Wire & Cable Company, Limited, Montreal, Canada.
Marking: Yellow thread woven in braid.
Standard, National Electrical Code, 1911 edition.
Approved December 18, 1912.

HEATERS, Electric.—O. A. Miller Treeing Machine Company, Brockton, Mass.
Miller No. 3 Electric Ironing Equipment, two amperes, 125 volts.
Portable electrical heating devices of this class present certain inherent hazards. The temperatures necessary for their normal use are high enough to cause fire if they are left in contact with combustible materials. As yet no adequate means have been brought forward for eliminating such hazards.
The construction and materials used in the Miller No. 3 ironing equipments and accompanying stands are judged suitable for the special uses intended.
Approved December 28, 1912.

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

Fig. 2.—Transformer.—Dongan Electric Company.

INSULATING JOINTS. — Barnes Brothers & McLeod, 782 Junction Avenue, Detroit, Mich.
Approved December 26, 1912.

RECEPTACLES, For Attachment Plugs.—Cutler-Hammer Manufacturing Company, Milwaukee, Wis.
"C-H" 6 amperes, 250 volts.
Concealed, catalog Nos. 7616, 7617.
Molding, catalog Nos. 7621, 7622.
Flush Receptacle, catalog Nos. 7611, 7612.
Approved December 20, 1912.

RECEPTACLES, Standard.—Benjamin Electric Manufacturing Company, 128 Sangamon Street, Chicago, Ill.
"Benjamin," 660 watts, 250 volts.
Catalog No. 6-C, with lamp grip.
Approved January 7, 1913.

SIGNS, Electric.—Consolidated Electric Sign Company, 1501-3 Sedgwick Street, Chicago, Ill.
"Simplex" Sign.
A sheet metal sign with interchangeable letters.
Approved January 13, 1913.

SOCKETS, Standard.—W. R. Ostrander & Company, 22 Dey Street, New York, N. Y.
"Ostrander" brass-shell sockets.
Keyless, 660 watts, 250 volts; catalog Nos. 2000-2009 inclusive.
Pull, 250 watts, 250 volts; catalog Nos. 1000-1009 inclusive.
Approved January 3, 1913.

SHADEHOLDERS. — The Bryant Electric Company, Bridgeport, Conn.
"New Wrinkle Emergency" Shadeholders; catalog Nos. 443-445 inclusive. These shadeholders have a fiber insulation between the exposed metal parts and an inner part which threads upon the screw shell of the lamp socket or receptacle.
Approved December 20, 1912.

SWITCHES, Automatic. — The Chemelectric Company, 4327 Kenmore Avenue, Chicago, Ill.
A line-disconnecting device for use with alternating-current elevator-motor equipments, consisting of a solenoid coil the core of which carries contacts by which the line is short-circuited in case of a change in phase relation in the circuit, thereby causing the fuses in the circuit to blow. The core and contacts are inclosed in a sheet-steel cabinet.
Approved January 7, 1913.

Fig. 3.—Standard Receptacle.—Benjamin Electric Manufacturing Company.

SWITCH BOXES.—R. E. McIntosh, 400 North Avenue 26, Los Angeles, Cal.
Pressed-steel boxes built in one, two, three and four gangs.
Approved January 13, 1913.

TRANSFORMERS.—Dongan Electric Company, 15-17 East Woodbridge Street, Detroit, Mich.
For indoor and outdoor use, 110 and 220-volt primary giving secondary voltages 55, 27.5, 22 or 11.
Capacities 250 to 1,250 watts.
Approved January 9, 1913.

TRANSFORMERS. — Viking Electric Company, 150-152 Chambers Street, New York, N. Y.
Transformers for use only for ringing bells or for similar signaling work.
Type E. W., 100-125 volts, primary; 6 volts secondary.
Approved December 20, 1912.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

MEDIAPOLIS, IOWA.—The City Council is considering an electric light plant. C.

MOULTON, TEX.—Local citizens have organized a company for the purpose of installing an electric light and waterworks plant. D.

ABERDEEN, WASH.—The City Council is considering a municipal lighting proposition.

WYOMING, MINN.—The village of Wyoming is figuring on electric lights being put in. C.

ANGLETON, TEX.—The Angleton Gin & Power Company will install an electric-light plant here. D.

WINONA, MINN.—The Association of Commerce is urging a "White Way" for the business section. C.

FONTANELLE, IOWA.—The City Council is considering the installation of an electric-light plant here. C.

MT. PLEASANT, IOWA.—Bids will be received until March 4 for furnishing electric-light fixtures for the court house. C.

ALBANY, ORE.—Plans and specifications are being prepared by Louis Kelsey, of Portland, for a municipal light plant.

WAVERLEY, MINN.—The Central Minnesota Light & Power Company has made a proposition to establish an electric light plant. C.

SPRING VALLEY, N. Y.—The Rockland Light & Power Company plans to run a new line of wires from Spring Valley to Suffern.

PERRY, IOWA.—There is talk of submitting to the spring election the proposition to raise funds for rebuilding an electric light plant. C.

SPOKANE, WASH.—Des Chutes Power Company has been incorporated with a capital stock of $300,000 by Samuel and Adolph Galland.

CAMANCHE, IOWA.—The Council has granted a franchise to the I. & I. Railway Company for establishing a lighting system in the town. C.

FOWLER, CAL.—The San Joaquin Light & Power Company has been granted a one-year contract for the installation of a new lighting system.

FRANKSTON, TEX.—Local citizens have organized an electric light and water company and will install an electric-light and waterworks plant in Frankston. D.

HEARNE, TEX.—The contract for installing a new electric-light power plant here has been awarded to Randall, Lovegrow & Wyman, of Houston. D.

OAKFIELD, WIS.—F. J. Bristol & Sons, who own real estate and buildings here, are preparing to install a private electric-light plant and water supply. C.

DE LEON, TEX.—De Leon-Gorman Light & Power Company has been incorporated with a capital stock of $20,000 by W. E. Lowe, J. T. Collie and W. M. Collie.

WARREN, MINN.—The Crookston Water Works, Power & Light Company is conferring with local authorities relative to transmission of power here for light service. C.

RICHMOND, IND.—The City Council will receive bids for the furnishing and installation of $70,000 worth of new machinery in the municipal electric light plant. S.

CLEVELAND, WIS. — Cleveland Light & Power Company has been incorporated with a capital stock of $5,000 by Charles Lorfield, August Erdman and Charles Wimmier.

DOWNIEVILLE, CAL.—Bids will be received until April 7 for a franchise to erect and maintain poles for transmitting electricity in Sierra County, on the application of Albert C. Agnew.

PITTSBURGH, PA.—The Pennsylvania Power Company, a subsidiary of the Mahoning & Shenango Valley Light Company, is making a survey for a dam on the Shenango River near Hazel Dell.

ROCHESTER, IND. — The Rochester Electric Light, Heat & Power Company has increased its capital stock $50,000, and will improve and extend the plant. New lines will be built throughout the rural districts. S.

REDFIELD, IOWA.—No bids were considered by the City Council and the town will erect its own power plant. About March 1 bids will be asked for combined electric light and water works systems, and for each system separately. C.

SPRINGFIELD, MASS.—The Miller's River Power Company has been incorporated with headquarters in this city. The capital stock is $1,000,000, and the incorporators are Fred T. Ley, Leo L. Ley and Joseph W. Johnson, all of Springfield. B.

YOAKUM, TEX.—It is announced by L. L. Stevens of Big Springs, Tex., who recently purchased the electric light and power plant here from the Yoakum Improvement Company, that he will spend $30,000 in enlarging and improving the property. D.

LIVINGSTON, MONT. — United States Senate Committee on Public Lands has reported favorably on the bill of Senator Mayers intended to allow the Conrad-Stanton Company to locate a power plant and run lines across Yellowstone Park. C.

CLARKSBURG, W. VA.—The Francois Coal & Coke Company, recently incorporated with a capitalization of $100,000, will in the near future buy electrical equipment for mines of 1,000-tons' capacity daily. E. J. Francois, of this city, is manager of the new company. G.

BUFFALO, KAN.—The Buffalo Electric Light & Power Company is the name of a new company which has been granted a charter for the purpose of furnishing Buffalo with a modern electric light plant. The company is capitalized at $10,000.

LEXINGTON, KY.—The City Council of Burnside has sold to the Kentucky Utilities Company, of which Harry Reid is manager, a franchise to furnish electric light in Burnside at a maximum rate of 12 cents per kilowatt-hour. The Kentucky's lines will be extended to Burnside as soon as possible. G.

OACOMA, S. D.—The People's Gas & Light Power Company, of Oacoma and Chamberlain, has been incorporated with a capital stock of $25,000 for the purpose of furnishing the two towns with light and power. The incorporators are Peter B. Dirks, W. R. Tapper, Henry McGrath and George M. Kennedy.

AUSTIN, TEX.—The commissioners' court of Travis County has granted the San Antonio & Austin Interurban Railway Company a franchise for the operation of cars over the bridge of the Colorado River in Austin for a term of fifty years. The construction of this line will soon be started, it is announced. The survey is now being made. D.

EVANSVILLE, IND.—Members of the West Side Business Men's Association will apply in the immediate future for a municipal franchise for a $100,000 electric light and power company which is to be organized. The new company will build and operate a central station and furnish cheaper service than has ever been known in the Southern Indiana city. Plans for the project are well under way. G.

DAYTON, O.—A new power plant is to be erected by the Ritchie-Wertz Company. Negotiations are now being conducted with the aim in view of erecting a four-story, strictly modern, concrete power plant. The need of a power plant is felt not only by this concern but by other Dayton industries and it is probable that factory accommodation will be furnished for other concerns as well. H.

CHATTANOOGA, TENN. — The Chattanooga & Tennessee River Power Company will begin at once the construction of a $1,000,000 steam-power plant. This will be operated in connection with the $8,000,000 plant now being erected at Hale's Bar, 15 miles from this city, where a lock and dam is being built across the Tennessee River. The capacity of the plant is to be 20,000 or 25,000 horsepower.

DIXON, MO.—A citizens' committee has secured promises of 350 lamps at 15 cents per kilowatt-hour. It is understood that at least 200 more lamps were secured at the same figure and that the town will invest at least

$25 a month in street lamps. The majority of citizens prefer to have some outside company put in the plant, and several parties in the town have expressed their willingness to take a small stock holding in the plant. The telephone company, it is understood, will make room on its poles for wires if this will be needed by the parties putting in the plant. G. G. Youngblood, chairman of the committee, will furnish full information.

NORRISTOWN, PA.—Under an arrangement with the Reading Company there will be a further large development of hydroelectric power at Manayunk and Norristown. About two years ago a 2,500-kilowatt plant was constructed at North Manayunk by the Philadelphia Hydro-Electric Company. The capacity of the plant, which sells the power generated to the Rapid Transit Company, is to be increased to 3,500 kilowatts. At the Schuylkill River dam at Norristown the same interests, through a new company called the Norristown Power Company, will construct a 1,500-kilowatt plant. It is probable that a third power plant will be constructed to utilize the Schuylkill River energy, as it is available at the Conshohocken dam. The understanding is that the Reading Company will have the right to buy the probable 7,500 kilowatts of power which can be developed at the three points, for use in operating its Norristown branch, when electrified. N.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

GILBERT, MINN.—The Range Telephone Company has been granted a franchise. C.

MASON CITY, IOWA.—An intercommunicating telephone system is planned for the court house. C.

LAKE CITY, MINN.—The Dwelle Telephone Company will put its wires underground in the business section of this city. C.

ALBERT CITY, IOWA.—The Albert City Telephone Company has been organized with a capital stock of $10,000. C.

SMYRNA, DEL.—The Severson's Rural Telephone Company has been incorporated for $10,000 by Jefferson D. Scout. N.

PLACENTIA, CAL.—The Pacific Telephone & Telegraph Company is to install a telephone exchange in this city immediately.

SHOALS, VA.—The Shoals Telephone Company has been incorporated with a capital stock of $1,000 by A. L. Scott and others.

WASHBURN, N. D.—A mutual telephone company has been organized with J. V. Williams, president, and will build 24 miles of line.

BISBEE, ARIZ.—Louis Wolff has been granted permission to install a telephone line between Guaymas and the towns in the Yacui River Valley.

SALYERSVILLE, KY. — Salyersville Telephone Company has been incorporated with a capital stock of $500 by Chick Patrick, B. K. Given and D. J. Wheeler.

NOME, N. D.—Nome Telephone Company has been incorporated with a capital stock of $25,000 by M. H. Wilberg, C. P. Miller and G. O. Peterson, all of Nome.

QUINCY, ILL.—The Central Union Telephone Company has announced that it will install a telephone and flashlight alarm-signal system for the police department. Z.

WASHINGTON, ILL.—The Washington Home Telephone Company contemplates the installation of a new switchboard. C. H. Cheadle, Joliet, is secretary and treasurer. Z.

CLEVELAND, O.—Brickner Telephone Company has been incorporated with a capital stock of $300 by David A. Eickholt, C. Mathies, Joseph Seize, Frank M. Brickner and John A. Nomina.

HOPE, N. J.—The Patrons' Telephone Company has acquired right of way and permission for the extension of its system to the vicinity of the new Lackawanna Railroad station, Blairstown. A.

ALGONA, IOWA. — A telephone company to be known as the South Cresco Telephone Company has been organized. Lee Miller is president. It will be connected with the Algona exchange. C.

MENO, OKLA.—The Farmers' Rural Telephone Company has been incorporated with a capital stock of $2,000 by P. P. Ratzlaff, C. E. Carlston, D. B. Unruh, P. W. Jantz, J. H. Bergdall, W. J. Marsh and C. P. Unruh, all of Meno.

MONTPELIER, VT.—Newbury Center Telephone Company has been incorporated with a capital stock of $5,000 by J. B. Tyler, M. L. Brock, A. A. Carleton, of West Newbury; William Rollins and J. F. Girge, of Wells River.

SAN FRANCISCO, CAL.—The Railroad Commission has ordered the establishment of a physical connection between the Pacific Telephone & Telegraph Company, the Tehama County Telephone Company and the Glenn County Telephone Company, upon the petition of the smaller companies, who desired to enable their patrons to use the Pacific Company's long-distance service.

HOPKINSVILLE, KY.—On March 3 a county telephone franchise will be offered for sale by the Christian Fiscal Court, pursuant to a decision which was recently arrived at. The Christian-Todd Telephone Company, a merger of two telephone companies which formerly competed in Christian and Todd Counties has raised in rates and, while it must answer for this action to the State Railroad Commission, the Christian court is determined to provide competition through the sale of a franchise. G.

ELECTRIC RAILWAYS.

(Special Correspondence.)

LYNN, MASS.—The Boston & Eastern Electric Railway Company will spend $3,000,000 in this city.

EVANSVILLE, IND.—The Public Utilities Company is preparing to build a branch interurban line from Fort Branch to Owensville. S.

ANAHEIM, CAL.—Bids will be received until March 4 for a franchise granting the right to construct and maintain for 50 years a single or double-track railroad in Orange County.

FERGUS FALLS, MINN.—Holders of the street car franchise granted some time ago will incorporate and begin construction work in the spring. U. A. Huss is president and John Haagenson, secretary. C.

VENUS, TEX.—Steps are on foot to construct an interurban electric railway between Dallas and Venus. The promoters of the project will be given a franchise for the use of the streets of Venus for the proposed line. D.

OKLAHOMA CITY, OKLA.—A plan for the construction of an interurban line from Muskogee to Oklahoma City is well under way. The project is being backed by Oklahoma City capital. The plan is to build the power plant in the city of Muskogee or immediate vicinity. P.

CUSHING, OKLA.—The City Council has submitted to popular vote a franchise granting the Cushing & Oil Field Electric Railway Company the right to construct and operate an electric railway in this city. Messrs. Strong and Nance, of Clinton, are the promoters of the road. P.

WACO, TEX.—John J. Potts, of this city, and associates are promoting the construction of an interurban electric railway to run between Waco and Temple, *via* Onaville, Mooresville and other towns. Another similar project is on foot, but the two proposed lines are to occupy different routes. D.

SPRINGFIELD, MASS.—The Stafford & Monson Street Railway Company has filed articles of incorporation and plans to build a trolley line between the two towns. It is also the desire of the petitioners to obtain authority to build another line from Stafford Springs to the State line at Wales.

INDIANAPOLIS, IND.—The officials of the Indianapolis & Delphi Interurban Railroad Company are making plans to let a contract for the construction of the road between Indianapolis and Delphi and intermediate towns. Eastern capitalists have financed the road. Henry L. Smith is secretary. S.

PORTSMOUTH, VA.—A new railway line about 50 miles long, operated by electric power and tapping the wonderfully fertile and practically virgin territory lying between this city, South Mills, Camden and Elizabeth City, N. C., is projected by enterprising business and professional men of this city and the Eastern Carolina metropolis, and it is stated that work will probably begin within the next few months and that trains may be running before the end of the present year. Dr. R. L. McMurran is at the head of the movement here. The new railroad is to be known as the South Mills, Portsmouth & Elizabeth City Railway Company, and the capital stock will not be less than $200,000.

CHARLOTTE, N. C.—The Piedmont Northern Lines, a newly formed organization, which has under construction a system of electric traction roads in the Carolinas, is contemplating the building of an extension to Atlanta. The Piedmont company is owned by a syndicate, headed by James B. Duke, which controls the Southern Power Company. One of the Piedmont lines, known as the Greenville, Spartanburg & Anderson Railway Company, is now completing the construction of a line between Greenville and Spartanburg, and when this is finished connection will be established between North and South Carolina divisions by the building of a line between Spartanburg and Gastonia.

NEW INCORPORATIONS.

VANDLING, PA.—The Vandling Electric Company has been incorporated with a capital of $5,000. N.

SALEM, WIS.—Salem Electric Company has been incorporated with a capital stock of $4,000 by William Peterson and others.

SCRANTON, PA.—Lackawanna Township Electric Company has been incorporated to operate here with a capital stock of $5,000.

TIOGA, PA.—The Tioga Valley Electric Company has been incorporated to operate in and around Tioga. The capital stock is $5,000. N.

FRANKFORT, KY. — McKinney Electric Company has been incorporated with a capital stock of $2,000 by M. McKinney, Eugene Hoge and W. H. Hoge.

SANTA ANA, CAL.—The Santa Ana Electric Company has been incorporated with a capital stock of $16,000 by T. W. Neely, Annie E. Neely and J. G. Quick and others.

PHILADELPHIA, PA.—The American Electro Slatum Company has been incorporated with a capital stock of $100,000 by George H. Niver, Lafayette Taylor, F. S. Rair, all of Philadelphia. N.

NEW YORK, N. Y.—Eagle Gas & Electric Fixture Company, Incorporated, has been granted a charter. The capital stock is $10,000 and the incorporators are Emanuel Chanin, William Chepakoff and Adolph Warshow, all of New York City.

CHICAGO, ILL.—Perfection Storage Battery Company has been incorporated with a capital stock of $2,500 for the purpose of dealing in electric storage batteries and accessories. The incorporators are Edward O. Briggs, Roscoe B. Higbee and William R. Fetzer.

NEW YORK, N. Y.—John Splitdorf Corporation has been incorporated with a capital stock of $350,000 to do a general electrical manufacturing business. The incorporators are John Splitdorf, New York City; P. J. W. Kelly, Jersey City, N. J.; and A. L. Kull, New Rochelle, N. Y.

NEW YORK, N. Y.—Broadway Electrical Novelty Company, Incorporated, has been granted a charter to deal in electrical supplies. The capital stock is $5,000 and the incorporators are Louis Rossheim and Leon Manson, of New York City and Isidor Rossheim, of Brooklyn, N. Y.

NEWARK, N. J.—National Electric Bulletin Corporation has been incorporated with a capital stock of $100,000 for the purpose of manufacturing electric bulletin machines. The incorporators are John G. Miller, Newark, N. J.; James W. Johnson, Hartsdale, N. Y.; and Arthur Knowlton, New York, N. Y.

PORTLAND, ORE.—The North Pacific Gas & Electric Company has been incorporated with a capital stock of $1,000,000 for the purpose of furnishing water, gas, electric current, light and heat in certain towns in Oregon and adjoining states. The incorporators are C. J. Franklin, F. L. Shulb and H. E. Lunsberry, of Portland, and W. W. Seymour and F. C. Brewer, of Tacoma, Wash.

LA PORTE, IND.—The La Porte Electric Company filed articles of incorporation with the Secretary of State. The capital stock is $1,000,000. The object and purpose of the corporation is to build, equip and operate a plant to furnish electricity to La Porte and all adjacent towns, cities, communities, places of amusement, exhibitions, etc., with light, heat and power. Benjamin C. Robinson, Claud W. Hurd, Charles M. Cook and William A. Martin are directors. S.

PROPOSALS.

MOTORS.—Sealed proposals will be received by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., until March 11, for miscellaneous motors for continuous duty, to be delivered at the Navy Yard, Philadelphia, Pa., as per Schedule 5204.

ELECTRIC MOTORS.—Sealed proposals will be received by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., until March 11 for one electric motor to be delivered at the Navy Yard, Washington, D. C., as per Schedule 5203.

ELECTROPLATING OUTFIT.—Sealed proposals will be received by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., until March 11 for one electroplating outfit, to be delivered at the Navy Yard, Boston, Mass., as per Schedule 5198.

FIRE-ALARM SYSTEM.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until March 17, for installing a fire-alarm system in the appraiser's warehouse at New York, N. Y. For further information address the Supervising Architect.

ELECTRIC CONDUIT AND WIRING AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until March 24, for the electric conduit and wiring and interior lighting fixtures for the post office at Weatherford, Tex., until March 25, for a one-story building for the post office at Tifton, Ga. Drawings and specifications may be obtained from the custodians of the sites or from the office of the Supervising Architect.

NEW PUBLICATIONS.

OHIO RIVER FLOW.—The United States Geological Survey has issued Water-Supply Paper No. 283 covering the Ohio River basin. It contains a large number of records of the flow of numerous tributaries of the Ohio River in 1910, and calls attention to the importance of long-time records of stream flow. Copies may be had gratis upon application to the director at Washington, D. C.

THEORY OF MAGNETISM.—"The Electron Theory of Magnetism," by E. H. Williams, has just been issued as Bulletin 62 of the Engineering Experiment Station of the University of Illinois. In the study of physical phenomena, various theories have been advanced, from time to time, as to the nature of magnetism. The most interesting and important of these is the electron theory. The bulletin traces the experimental advance leading to the development of this theory in its present status, and points out phenomena which the theory in its present form fails satisfactorily to explain. Copies may be obtained upon application to W. F. M. Goss, Urbana, Ill.

FINANCIAL NOTES.

So many untoward incidents have loomed large on the horizon of national and international affairs that the outlook for the market is somewhat obscure. Speculative conditions have been seriously complicated by the outbreak of rebellion in the Mexican capital and the threatened strike of the firemen on the eastern railroads. Notwithstanding these disturbances in big affairs, local trade conditions appear to continue in excellent shape, and reports from jobbers and manufacturers in the electrical industry indicate a continuation of considerable activity and prosperity.

There is a proposition now before the Maine Legislature to increase the capital stock of the Cumberland Light & Power Company from $5,000,000 to $10,000,000.

It is reported that the United Light & Railways Company is negotiating for the purchase of additional power and traction corporations, including the People's Gas & Electric Company, of Mason City, Iowa, and the Mason City & Clear Lake Interurban Company. A contract is to be made by which the United Company will operate the Iowa & Illinois Electric Railway Company, which operates a line 40 miles long between Davenport and Clinton. The Iowa City Gas & Electric Company is also one of the companies which the United Company expects to take over. Gross earnings of all its present subsidiaries, numbering about 15, were $2,464,838 for the six months ended December 31, 1912, an increase of 10.4 per cent over the corresponding period of 1911.

Dividends.

Chicago Elevated Railways Collateral Trust; a dividend of 1.5 per cent, payable March 1 to stock of record February 18.

Continental Gas & Electric Corporation; an initial quarterly dividend of 0.5 per cent on the common stock, to be paid July 1, will be declared April 1.

Reports of Earnings.

WINNIPEG ELECTRIC RAILWAY COMPANY.

Gross earnings of the Winnipeg Electric Railway Company for the year ended December 31, 1912, were $3,765,364, as against $3,829,749 in 1911. Surplus, after all charges and payment of $750,000 in dividends, was $474,463. Total accumulated surplus December 31, 1912, was $2,091,326.

At the annual meeting, directors and subsequently officers, were re-elected.

AMERICAN LIGHT & TRACTION.

The report of the American Light & Traction Company for the year ended December 31, 1912, shows net earnings of $4,139,203, against $4,030,242 in 1911. After deducting preferred dividends of $854,172 the balance, $3,285,031, is equal to 26.05 per cent earned on the common stock. The income account compares as follows:

	1912	1911
Gross earnings	$ 4,256,860	$ 4,144,053
Expenses	117,657	113,810
Net earnings	4,139,203	4,030,242
Surplus and reserve previous year	7,835,726	6,862,631
Total surplus	11,974,929	10,892,874
Cash dividend on preferred stock	854,172	854,172
Cash dividend on common stock	1,215,732	1,101,387
Stock dividend on common stock	1,215,732	1,101,587
Total dividends	3,285,636	3,057,147
Profit and loss surplus	8,689,293	7,835,726

DETROIT UNITED RAILWAY COMPANY.

The Detroit United Railway Company has issued its report for the year ended December 31, 1912. The consolidated income account compares as follows:

	1912	1911
Gross earnings	$11,695,530.	$10,253,134
Operating expenses	7,730,409	6,580,042
Net earnings	3,965,121	3,673,092
Other income	208,857	178,812
Total income	4,173,978	3,851,904
Interest, taxes, etc.	2,123,513	2,123,398
Depreciation, etc.	600,000	400,000
Total deductions	2,723,513	2,523,398
Surplus	*1,450,465	1,328,506
Dividends	625,000	625,000
Surplus	825,464	703,506

*Surplus, after allowing for depreciation, etc. ($600,000), is equal to 11.6 per cent on $12,500,000 capital stock as against 10.62 per cent earned on same stock previous year.

At the annual meeting of the Detroit United Railway Company retiring directors, and subsequently officers, were re-elected.

UNITED RAILWAY OF ST. LOUIS.

The United Railways of St. Louis has issued its pamphlet report for the year ended December 31, 1912. The income account compares as follows:

	1912	1911
Gross	$12,251,091	$11,914,153
Expenses, taxes and depreciation	8,480,724	7,990,062
Net	3,770,367	3,924,091
Other income	64,917	44,729
Total income	3,835,284	3,968,820
Charges	2,696,197	2,740,305
Balance	1,039,088	1,228,515
Preferred dividends		
Surplus	*1,039,088	1,228,515

*Equal to 6.3 per cent on $16,383,200 outstanding preferred stock, as against 7.5 per cent earned on same stock previous year.

UNITED GAS AND ELECTRIC CORPORATION.

The United Gas & Electric Corporation reports earnings for the year ended December 31, 1912, accruing to it through its holdings of shares of constituent companies as follows:

Earnings of shares owned	$1,148,628
Interest on convertible notes	275,000
Balance for preferred stock	873,628
Dividends on preferred stock	555,288
Balance for common stock	318,340
Rate earned on common stock	3.82%

United Gas & Electric Corporation began business June 6, 1912, but for the purpose of ascertaining the amount applicable to dividends on the preferred stock of the new company for the full year, there has been assumed the earnings from the various companies which went into the consolidation, covering the period from January 1, 1912, to June 6, 1912.

COMMONWEALTH EDISON COMPANY.

The Commonwealth Edison Company has issued its report for the year ended December 31, 1912. The previous report of the company covered the 15 months ended December 31, 1911. We compare the income accounts as follows:

	1912	1911
Gross operating rev.	$15,361,649	$17,336,835
Expenses and depreciation	8,855,572	9,594,605
Net operating rev.	6,506,077	7,742,229
Taxes and municipal compensation	1,127,195	1,316,702
Operating income	5,378,882	6,425,527
Other income	203,347	192,025
Total income	5,582,229	6,617,552
Interest	1,600,000	1,919,943
Balance	3,982,229	4,697,609
Depreciation reserve	544,000	680,000
Surplus	*3,438,229	4,017,609
Dividends	2,516,783	2,712,315
Surplus	921,445	1,304,293

*Equal to 10.4 per cent on $32,964,800 capital stock as against 12.2 per cent earned in same stock for the 15 months ended December 31, 1911, which is at the rate of 9.76 per cent per year.

WEST PENN TRACTION & WATER POWER.

The consolidated income account of the West Penn Traction & Water Power Company for the year ended December 31, 1912, follows:

Gross receipts	$3,408,586
Expenses and taxes	1,829,460
Net earnings	1,579,127
Interest charges	794,748
Preferred dividend West Penn Railways	137,500
Preferred dividend West Penn Traction	97,500
Surplus	549,378

CHICAGO TELEPHONE COMPANY.

The Chicago Telephone Company has issued its report for the year ended December 31, 1912. The income account compares as follows:

	1912	1911
Gross revenue	$14,538,399.	$12,678,391
Expenses, repairs and maintenance	†12,003,986	10,415,850
Net revenue	*2,534,413	2,262,540
Dividends	2,160,000	2,160,000
Surplus	374,413	102,540

*Equal to 9.38 per cent earned on $27,000,000 capital stock, as compared with 8.38 per cent earned on same stock previous year.

†Includes $2,063,594 for maintenance.

During the year $14,000,000 additional bonds were issued on a favorable market. Out of proceeds, the company paid some $3,000,000 of debt, $1,000,000 of which was in bills payable account of last year; $10,300,000 is represented by six-per-cent demand notes of the Central Union Telephone Company, guaranteed by American Telephone & Telegraph Company. Estimates for new construction approximate $10,000,000.

MOUNTAIN STATES TELEPHONE.

The Mountain States Telephone & Telegraph Company has issued its annual report for the year ended December 31, 1912. The income account follows:

Gross	$6,844,576
Operating expenses and taxes, etc.	3,292,042
Maintenance	1,039,163
Net earnings	*2,513,371
Dividends	1,587,334
Surplus and reserves	926,037

*Equal to 9.3 per cent on $26,994,200 common stock outstanding.

The report states that a comparison between the years 1912 and 1911 is manifestly difficult, if not almost impossible, without entering into great detail. The statement for the year 1911 was made up by combining the individual earnings of the three merged companies prior to their consolidation, and adding to this total the actual gross earnings of the Mountain States Company for the period of its existence in 1911. The surplus for dividends thus arrived at was $1,066,124.

FEDERAL LIGHT & TRACTION COMPANY.

The Federal Light & Traction Company reports for December, 1912, and the twelve months ended December 31, 1912, as follows:

	1912.	1911.
December gross	$ 173,865	$ 151,556
December net	72,180	66,884
Twelve months gross	1,722,647	1,496,177
Twelve months net	714,612	609,082

SOUTHERN CALIFORNIA EDISON.

The report of the Southern California Edison Company for the year ended December 31, 1912, shows net earnings of $2,001,414, an increase of $109,134. The balance available for dividends on the common stock was equal to 13.21 per cent on the outstanding issue, as compared with 9.7 per cent in 1911. A summary of the income account for December and the twelve months compares as follows:

	1912.	Increase.
December gross	$ 368,777	$ 19,692
December net	201,253	*27,238
December surplus	159,220	7,111
Twelve months' gross	4,340,500	602,335
Twelve months' net	2,001,414	109,134
Twelve months' surplus	1,309,883	32,432
Twelve months' preferred dividends	200,000	200,000
Twelve months' balance for common stock	1,109,883	.....

AMERICAN GAS & ELECTRIC SUBSIDIARIES.

The Atlantic City Electric Company, the Canton Electric Company, the Muncie Electric Company, the Rockford Electric Company and the Scranton Electric Company, subsidiary corporations of the American Gas & Electric Company report earnings for December, 1912, and the twelve months ended Dec. 31, 1912, as follows:

	1912	1911
Atlantic City Electric:—		
December gross	$ 38,121	$ 32,473
December net	19,819	19,263
December surplus	11,050	10,681
Twelve months gross	451,634	418,796
Twelve months net	264,044	235,253
Twelve months surplus	160,084	142,477
Canton Electric:—		
December gross	$ 35,070	$ 31,937
December net	18,172	14,905
December surplus	13,473	10,048
Twelve months gross	347,249	305,716
Twelve months net	175,201	156,158
Twelve months surplus	118,417	101,170
Muncie Electric Light:—		
December gross	$ 41,209	$ 33,968
December net	17,430	16,385
December surplus	8,185	10,243
Twelve months gross	389,170	312,426
Twelve months net	166,080	130,646
Twelve months surplus	84,755	61,633
Rockford Electric:—		
December gross	$ 43,914	$ 40,389
December net	24,074	21,153
December surplus	16,123	13,386
Twelve months gross	417,319	386,653
Twelve months net	202,827	175,506
Twelve months surplus	108,400	85,584
Scranton Electric:—		
December gross	$ 79,892	$ 74,994
December net	50,998	46,089
December surplus	37,497	34,057
Twelve months gross	802,192	729,453
Twelve months net	448,911	417,044
Twelve months surplus	297,963	280,901

*Decrease.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Feb. 17.	Feb. 10.
American Tel. & Tel. (New York)	133⅛	132⅛
Commonwealth Edison (Chicago)	142	144⅝
Edison Electric Illuminating (Boston)	282	289½
Electric Company of America (Philadelphia)	12	12
Electric Storage Battery common (Philadelphia)	52½	53⅛
Electric Storage Battery preferred (Philadelphia)	52½	53⅛
General Electric (New York)	139	141
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1⅜	1⅜
Massachusetts Electric common (Boston)	17	18½
Massachusetts Electric preferred (Boston)	77½	78½
National Carbon common (Chicago)	121	119
National Carbon preferred (Chicago)	116	115¾
New England Telephone (Boston)	157	158
Philadelphia Electric (Philadelphia)	23½	23⅞
Postal Telegraph and Cables common (New York)	86	81
Postal Telegraph and Cables preferred (New York)	67	67
Western Union (New York)	70¼	72¼
Westinghouse common (New York)	71	73
Westinghouse preferred (New York)	118	117½

*Last price quoted.

PERSONAL MENTION.

HOLT DANIELS, of Paris, Ky., has become assistant general manager of the Danville, Light, Power & Traction Company, of Danville, Ky.

RICHARD F. NOVELL has associated himself with the Massachusetts Chemical Company as traveling salesman and special representative.

W. C. MUMAW, manager of the Pacific Telephone Company at Aberdeen, Wash., has been elected president of the Aberdeen Chamber of Commerce.

ELIHU THOMSON delivered an address at the Franklin Institute on Wednesday evening, February 19, on the subject of "Transmission of Electrical Energy."

EDWARD B. ROSA, physicist of the Bureau of Standards, Washington, D. C., and in charge of the electrical work at the Bureau, has been elected a member of the Council of the French Physical Society.

P. C. KAERCHER, who has been purchasing agent of the Mahoning & Shenango Railway & Light Company, Youngstown, O., has been promoted to the power sales department as assistant to T. L. STURGEON. C. O. BAILEY, who has been assistant purchasing agent, has been made purchasing agent to succeed Mr. Kaercher. G. L. RANDALL has been promoted to assistant purchasing agent.

ALEXANDER D. DUBOIS, assistant professor of electrical engineering at Purdue University, has resigned due to ill health. Professor DuBois has been at Furdue for the last four years and is a graduate of the University of Illinois.

H. E. CLIFFORD, who holds the McKay professorship of electrical engineering at Harvard University, will go in the second half-year to Annapolis, Md., to organize graduate study in electrical engineering at the Naval Academy.

T. COMMERFORD MARTIN, secretary of the National Electric Light Association, on February 13 delivered an address on the subject of "Good Will in Public Utilities," before the Commercial School of the New York Edison Company.

VLADIMIR POULSEN and P. O. FEDERSEN have been decorated with the merit of gold by King Christian on account of the honor they have brought to Denmark by their work in connection with wireless telegraphy and telegraphones.

JOHN W. LIEB, JR., third vice-president and associate general manager of the New York Edison Company, delivered an address on "Rates" before the New York Companies Section of the National Electric Light Association on Monday evening, February 17.

HOWARD F. TANSEY, of the construction department of the Dayton Light & Power Company, Dayton, O., delivered an interesting lecture on the Panama Canal to the employees of the company on Friday evening, February 14. Mr. Tansey spent the month of January at the Canal Zone.

S. W. MOWER has been made manager of the lighting companies allied with the Hartwick Power Company and the Otsego & Herkimer Railroad in New York. The companies are the Richfield Springs Light & Power Company, Cooperstown Gas Company and Clinton Mills Power Company.

FREDERICK BECKMAN, for the past 13 years manager of the Bloomington, Ill., office of the Central Union Telephone Company, has been promoted and will be in charge of the plants owned by the company in McLean and adjoining counties. Mr. Beckman will be succeeded by J. L. THOMAS in Kankakee, who will be succeeded at the latter city by THOMAS BROWN of Galesburg.

T. F. WHITFIELD, for the past 14 years connected with the Northern Electrical Manufacturing Company of Madison, Wis., and the Fort Wayne Electric Works, Fort Wayne, Ind., as Milwaukee representative, has opened offices at 1040 Wells Building, Milwaukee, under the firm name of the Whitfield Power Equipment Company and will make a specialty of engineering and installing dynamos, motors, engines and boilers.

WILLIAM P. BEAR, who for some time handled industrial and power work for the Westinghouse Electric & Manufacturing Company, in the Carolinas, but later for the States Electric Company, Chicago, is now sales engineer with the Sprague Electric Works of the General Electric Company, Chicago office, having taken up the new position on February 1. The purpose of the newly created department is to provide complete electrical requirements for large buildings.

ALFRED STILL has resigned his position as chief electrical engineer to the Algona Steel Corporation of Sault St. Marie, Ontario, Can., and taken charge of the courses in electrical design at the School of Electrical Engineering, Purdue University, LaFayette, Ind. Mr. Still is a member of both the American and British Institutes of Electrical Engineers. He has made a special study of hydroelectric developments and long-distance transmission of electric energy, and has only lately returned from a trip to Colorado and the Pacific Coast, where he visited many of the important systems of power transmission and distribution.

HERBERT H. CUDMORE, for a number of years manager of the Brilliant Electric Lamp Works of the General Electric Company, is the recipient of a distinguished honor and well earned promotion. At a recent meeting of the sales managers of the National Quality Lamp Division of the General Electric Company he was selected as arbitrator in charge of the department of arbitration, with headquarters in New York City adjoining the office of A. S. Terry, supervisor of the incandescent-lamp business of the General Electric Company and its licensees. Mr. Cudmore, than whom none is more popular in the incandescent lamp or any other field, will have the good wishes of a host of friends and acquaintances for his success in the new position.

OBITUARY.

JOHN FRITZ, the distinguished iron and steel master, died at his home at Bethlehem, Pa., on February 13, aged 91 years. Mr. Fritz began his career in 1838 as an apprentice in the blacksmith trade. He was born in Londonderry Township, Chester County, Pa. Mr. Fritz first became interested in foundry work after the construction of a mill for rolling bar iron at Coatesville, Penn., in 1844. He entered the employ of this plant, and in six months was in charge as ironmaster. So successful was he in the work of increasing the efficiency of the plant, that he was called upon in 1854 to assist in constructing the famous Cambria Works at Johnstown, Pa., and there he introduced many engineering innovations. In 1860 he entered the service of the Bethlehem Iron Company as general superintendent and engineer and built the works for the company. By this time he was widely known in the iron industry, and the Federal Government engaged his services for the mill established at Chattanooga, Tenn., during the civil war. The introduction of the epoch-making Bessemer process for the production of steel in the United States came in 1864, and Fritz was one of the first to realize its value and possibilities. In this work he was closely associated with Alexander L. Holley, the engineer. He took advantage also of the kindred process invented by William Kelly, an American. When Andrew Carnegie came into the steel industry at the close of the civil war Mr. Fritz was at the Bethlehem plant, and it was found that under changed conditions the manufacture of the Bessemer rails there was unprofitable. Under the direction of Mr. Fritz the plant was immediately put in condition to make structural material, such as is now used in bridge and "skyscraper" construction, and also for the manufacture of large shafting and armor plate. In 1897 he was selected by the Armor Plate Board to make plans and estimates for a Government armor plate works. In 1893 Mr. Fritz was elected an honorary member of the Iron and Steel Institute of Great Britain, from which he received the Bessemer gold medal for services in the advancement of steel manufactories. He was chosen honorary vice-president of the Institute in 1909. He was selected as a member of Group I, at the Centennial Exposition in Philadelphia in 1876, and honorary expert on iron and steel at the St. Louis Exposition in 1904, and received the John Fritz medal from the United Engineering Societies in 1902 and the Elliott Cresson medal from the Franklin Institute in 1910. Mr. Fritz has the distinction of being the only American for whom national engineering societies founded gold medals. The American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers united to establish a medal in his honor. Subscriptions of $10 were invited from the members of these societies, and a fund of $6,000 was contributed. A gold medal designed by Victor Brenner was executed to be awarded each year for achievement in the industrial arts and sciences by a joint committee of these societies. He was also a former president of the American Institute of Mining Engineers, and an associate fellow of the American Academy of Arts and Sciences. Mr. Fritz received the honorary degree of Master of Arts from Columbia in 1898, the degree of Doctor of Sciences from the University of Pennsylvania in 1906, and the degree of Engineer from Stevens Institute of Technology in 1907. He was a trustee of Lehigh University.

DATES AHEAD.

American Institute of Electrical Engineers. Midwinter convention, New York, N. Y., February 26-28.

Central Electric Railway Association. Annual meeting, New Washington Hotel, Indianapolis, Ind., February 27-28.

The Society for Electrical Development, Incorporated. Special general conference, New York, N. Y., March 4-5.

Boston Automobile Show, Mechanics' Building, Boston, Mass., March 8-22.

Minnesota Electrical Association. Annual convention, St. Paul, Minn., March 11-13.

American Electrochemical Society. Spring meeting, Hotel Traymore, Atlantic City, N. J., April 3-5.

Mississippi Electric Association. Annual convention, Natchez, Miss., April 21-23.

Iowa Electrical Association. Annual convention, Waterloo, Ia., April 23-24.

The Society for Electrical Development, Incorporated. Annual meeting, New York, N. Y., May 13.

National Fire Protection Association. Annual meeting, New York, N. Y., May 13-15.

Association of Railway Telegraph Superintendents. Annual meeting, St. Louis, Mo., May 20.

Southwestern Electrical and Gas Association. Annual convention, Galveston, Tex., May 21-24.

National District Heating Association. Fifth annual convention, Indianapolis, Ind., May 27-29.

National Electric Light Association. Annual convention, Chicago, Ill., June 2-5.

National Electrical Contractors' Association. Annual meeting. Chattanooga, Tenn., July 16.

With the Electrical Manufacturers

Hemming Manufacturing Company, Garfield, N. J., has, owing to the increasing demand in the West for its heat-resisting molded insulation, appointed B. A. Appleton western sales manager, with headquarters at 1654 Monadnock Block, Chicago, Ill.

The F. W. Wakefield Brass Company, Vermilion, O., has sent out a folder showing a variety of new, simple and inexpensive, but neat, fixtures suitable for a six or eight room house. The fixtures are chiefly square-stem or chain pendants and showers and are assembled from a relatively small number of parts, two of which are new.

H. W. Johns-Manville Company announces the removel of its Newark, N. J., office to 239 Halsey Street. The new office and salesroom is located on the ground floor of a modern building in the heart of the city's business center. With a floor area of 4,000 square feet, ample space is afforded for the display of a varied line of J-M asbestos roofings, packings, and pipe coverings, brake lining and automobile accessories, Noark fuses and protective devices, Frink lighting fixtures, etc.

Atlantic Insulated Wire & Cable Company, New York, N. Y. has recently issued a booklet giving new list of prices and freight additions on its Dolphin brand New-Code wires and cables for 600-volt service. This list is known as the New Universal Code list adopted by a large number of manufacturers in the interest of uniformity and at the request of the general consumers, contractors and supply houses, many of whom have already incorporated it in their catalogs. With the copper market as variable as it has been recently this booklet, covering the various bases, enables buyers to have constantly before them a complete range of prices without awaiting receipt from the manufacturers of a new list each time the copper base changes. The booklet will be sent on request by the company to those desiring to procure them.

The Pyrene Manufacturing Company, 1358 Broadway, New York, N. Y., is calling attention to the Pyrene fire extinguisher, which is especially adopted for subduing fires in electrical equipment. The manufacturer states that Pyrene liquid may be directed between the commutator and the brushes, or the armature and field of any moving electrical machine without in any way causing damage to the apparatus or injury to the operator, irrespective of the voltage used. This applies as well to controller boxes, rheostats, transformers, switchboards and any other electrical equipment. It is also claimed that Pyrene will break an arc caused by short-circuit, and when broken the arc will not re-establish. The Pyrene extinguisher is in the form of a well designed gun, either brass-finished or nickel-plated, and has been approved by the National Board of Fire Underwriters. It is 3 inches in diameter, 14 inches long, and weighs, when filled, 5 pounds.

The Bristol Company, Waterbury, Conn., has issued a condensed catalog of Bristol's recording instruments for pressure, temperature, electrical measurements, speed, time, etc. This covers 64 pages and gives a good idea of the great variety of recording instruments made by this firm. Catalog No. 1200, also issued by this company, describes Bristol's Class II recording thermometers, which are adapted for showing graphically temperatures between 90 and 500 degrees Fahrenheit. These are made in considerable variety of forms to adapt them to various special applications. The recording charts are always circular and are either 6, 8 or 12 inches in diameter. The thermometers are connected by means of flexible tubing with the apparatus or place whose temperature is to be recorded and the instruments themselves may be installed at any convenient point, such as the office. A long but only partial list of users of these recording thermometers is also given.

St. Louis Rubber Cement Company, 3044 Lambdin Avenue, St. Louis, Mo., for the past eight years has been manufacturing rubber cements of all kinds. During the last year it has branched out along lines that require crude rubber. The two principal lines are friction tape and splicing compound for the electrical trade. The company has erected a large two-story building and installed the latest mills and calenders, and is turning out four grades of black friction tape, two of gray friction tape and seven grades of rubber splicing compound. The plant capacity is 5,000 pounds daily, and since making the first shipment of tape on March 1, 1912, the company has been compelled to run its factory until ten o'clock each night to fill the orders on these lines. The company motto is "Where quality counts we win" and it works more toward quality than price. The Chicago office is at 217 West Lake Street, under the management of P. R. Acton. Its geographical location gives the company excellent facilities for quick delivery, as it has direct railroad transportation facilities to all the large central and Western cities of the United States.

Massachusetts Chemical Company, 185 Summer Street, Boston, Mass., is offering to the electrical trade three new insulating varnishes. Walpole clear insulating varnish is an amber-colored varnish of exceptional flexibility and penetrating qualities. It is said to be without an equal for resisting high voltages for long periods and comes through intact when given an initial puncture test of 1,000 volts per mil of thickness. Walpole black insulating varnish is oilproof, waterproof and acidproof, and of even higher initial resistance—1,500 volts per mil being guaranteed by the makers. It is especially adapted for insulating armatures and field coils of street-railway motors, which must stand up under abuse and neglect, as well as the high temperatures of overloads. These two baking varnishes are supplemented by a new Walpole black varnish, designed for finishing coats and made on an alcohol base which permits air drying in 30 minutes. This finishing varnish gives a tough, elastic, water, acid, and oilproof coat which remains black and lustrous. A booklet is being distributed to those users who desire directions for so applying these varnishes that they will give the best service. This and samples and prices may be obtained by interested parties by addressing the company.

Record of Electrical Patents.

Issued by the United States Patent Office, February 11, 1913.

1,052,449. Battery Box. C. W. Beck, assignor to Michigan Motor Specialties Co., Detroit, Mich. Has an inner case with a compartment for each dry cell, and an outer case.

1,052,478. Variable-Speed Alternating-Current Motor. M. M. Goldberg, Ithaca, N. Y. On an axial extension of the induction motor is a frequency transformer with commutator.

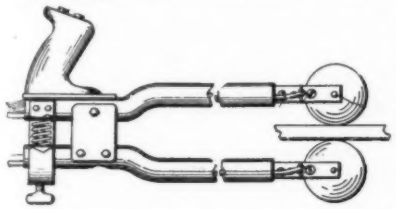
1,052,488. Electric Lock. C. Legrand and A. Armel, Paris, France. Has an electromagnet for locking the bolt in locked position.

1,052,490. Electric Welding-Tool. C. A. Linden and C. A. Carlson, Jamestown, N. Y. Has two pivotally connected and spring pressed electrode arms, each terminating in a wheel electrode.

1,052,491. Electric Welding-Machine. C. A. Linden and C. A. Carlson, Jamestown, N. Y. A grooved-wheel electrode bears on the corner to be welded, the work being held in an adjustable mandrel on a carriage.

1,052,496. Speed-Controlling Apparatus. W. H. McClelland, Jr., Wilkinsburg, Pa. A generator is driven at constant speed by a varying-speed source through a governor-controlled disk moved radially over the face of the driving disk.

1,052,513. Telegraph System. E. Pope, Quebec, Que., Canada. The signals are modified alternations of current.



1,052,490.—Wheel-Electrode Welding-Tool.

1,052,522. Electric Hair-Brush. V. Sence, New York, N. Y. Mounted on the brush is a small hand-operated magneto connected electrically to the metallic handle and to the bristles.

1,052,528. Inductive Controlling Apparatus. A. Sundh, assignor to Otis Elevator Co., Jersey City, N. J. An inductive adjustable controller for dividing the current between two parallel elevator induction motors.

1,052,535. Field Magnet. E. Volkers, Berlin, Germany. Pole construction for a revolving-field machine.

1,052,538. Electric Alarm System. A. U. Weaver and S. E. Weaver, Santa Anna, Tex. When light falls upon a selenium cell the latter closes the alarm circuit.

1,052,548. Telegraph-Transmitter. J. E. Wright, New York, N. Y. Character keys control an impulse selector.

1,052,550. Electrical Switch. M. F. Young, Pueblo, Colo. An electric-motor-operated track switch.

1,052,555. Meter-Service Lead Connection for Three-Wire Systems. P. H. Bacon, New York, N. Y. The meter's potential circuit includes a fuse and is connected on the service side of the fuse in one of the outer leads.

1,052,575. Starter. J. B. Entz, Cleveland, O. When the switch for the starting motor for a gasoline engine is closed, the ignition circuit is opened.

1,052,583. Protecting Device for Vapor Apparatus. P. C. Hewitt, assignor to Cooper Hewitt Electric Co., New York, N. Y. A rectifier tube is X-shaped.

1,052,584. Cooling Device for Vapor Electric Apparatus. P. C. Hewitt, assignor to Cooper Hewitt Electric Co., New York, N. Y. A circulation of cooling liquid is maintained through tubes passing across the center of the vapor bulb.

1,052,587. System of Electrical Control. J. D. Ihlder assignor to Otis Elevator Co. Automatically reduces the speed of the elevator motor when the car approaches its upper limit and holds the car there by the motor torque.

1,052,595. Circuit-Breaker. R. C. Lanphier, assignor to Sangamo Electric Co., Springfield, Ill. Relates to the plunger and associated details.

1,052,608. Meter-Testing Cut Out. A. V. A. McHarg, New York, N. Y. Includes a base with service, load and meter terminals, a gang switch and a gang plug.

1,052,619. Automatic Control for Air-Compressors. W. L. Pickett, Bridgeport, Conn. A pressure-gauge-controlled electromagnet is associated with the governor.

1.052,632. Train Signaling and Controlling System. J. F. Webb, Jr., assignor to Electric Signagraph & Semaphore Co., New York, N. Y. Includes an electric motor associated with a track stop.

1.052,642. Electric Outlet Box. A. I. Appleton, assignor to Chicago Fuse Manufacturing Co., Chicago, Ill. The box has an opening in one edge of one wall, this being closed by an interlocking shaped plug.

1,052,674. Thermostat. L. A. Lindsey, Armuchee, Ga. Movement of a diaphragm actuates an electric alarm circuit.

1,052,717. Rotary Transformer. E. M. Fraser, Yonkers, N. Y. Aside from the stationary field and interpole coils and stationary commutator brushes, there is a set of rotating auxiliary poles and brushes.

1,052,724. Electric Burglar-Alarm Device. R. C. Jones, Brooklyn, N. Y. A window-sash circuit-closer.

1,052,727. Process of Extracting Aluminum from Its Ores. Aluminum carbide is formed first, then changed to sulphide in viscous form and electrolyzed in a molten alkaline-earth-solvent bath.

1,052,730. Electrical Heating Unit. F. Kuhn and F. E. Shailor, assignors to American Electrical Heater Co., Detroit, Mich. Relates to the clamping of the resistance, terminal and insulating plates.

1,052,743. Timer. A. R. Mosler, assignor to A. R. Mosler & Co., New York, N. Y. For an electric ignition outfit.

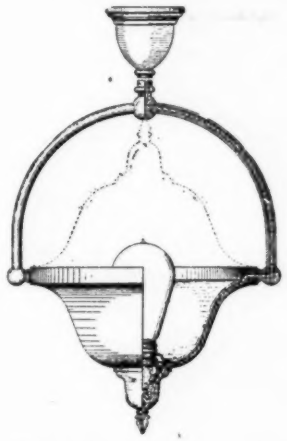
1,052,573. Transformer for Electric Metal-Working Apparatus. A. F. Rietzel, assignor to Universal Electric Welding Co., New York, N. Y. Has a low-voltage secondary and three welding terminals.

1,052,787. Clamp for Electric Metal-Working Apparatus. G. E. Barstow, assignor to Thomson Electric Welding Co., Lynn, Mass. A pivotally mounted adjustable clamping jaw for a welding machine.

1,052,816. Thermostat. W. S. Hadaway, Jr., assignor to Westinghouse Electric & Manufacturing Co. Surrounding an electric heating element is an insulating envelope and a metallic thermostatic sheath in the form of a spiral.

1,052,820. Process of Brazing Tubing. H. Higgin, assignor to Higgin Manufacturing Co., Newport, Ky. An electric current is used to heat the tube.

1,052,823 and 1,052,824. Power-Actuated Hand Tool. M. Irvine, Philadelphia, Pa. Includes an electric motor, an air-compressing member, and pneumatic hammer piston.



1,052,992—Convertible Fixture.

1,052,834. Air-Heater. J. Lawrence, New York, N. Y., assignor to Electric Heat Storage Co. Comprises a group of electric heating elements imbedded in a metallic block with air passages and a fan to drive the air through the heating unit thus formed.

1,052,843. Electrical-Resistance Device. E. J. Ovington, assignor to Simplex Electric Heating Co. Cambridge, Mass. An immersion heating element with an outer metallic shell closely fitting the resistance.

1,052,849. System of Radiotelephony. W. Schloemilch and P. F. Pichon, assignors to Gesellschaft für drahtlose Telegraphie M. B. H., Berlin, Germany. Has loose coupling between the exciting and transmitting circuits and rigid coupling between the receiver circuit and integrating detector.

1,052,876. Photographic-Printing Device. H. Albert, New York, N. Y. Includes an electric lamp and control therefor.

1,052,889. Adjustable Support for Electric Lamps. A. Cohn, West Hoboken, N. J. An adjustably suspended rod with a clamp for holding a pendent lamp.

1,052,891. Current-Controlling De-

vice. L. O. Corell, Kalamazoo Mich. An electromagnetic circuit-closer.

1,052,894. Electrically Heated Stove. A. S. Cubitt, assignor to General Electric Co. An oven with heat-insulated walls has a main and an auxiliary heater, the latter giving a higher temperature than the main heater and operating only while the door is open.

1,052,903. Electric Switch or Cutout. P. Druseidt, Remscheid, Germany. In a casing is a pair of balls, one conducting and the other non-conducting, and a push-pin.

1,052,914. Lock Mechanism for Controller Arms. E. Gruenfeldt, assignor to Baker Motor Vehicle Co., Cleveland, O. Includes a lock, a rock shaft and a latch.

1,052,920. Switch. H. D. Hinckley, assignor to J. B. Hart, Hartford, Conn. An inclosed switch with electromagnetically controlled latch.

1,052,932. Electric Automatic Alarm. W. Maginot, Hammond, Ind. A thermostatically controlled bar acts as a circuit-closer.

1,052,950. Fuse. J. H. Palmer, Chicago, Ill. A cartridge fuse with special caps at each end.

1,052,955. Electric Stop-Motion Mechanism. J. A. Poirier, Woonsocket, R. I. Breakage of thread in sewing machine closes the motor-stopping circuit.

1,052,957. Electric Trap. R. H. Pryor, Pittsburgh, Pa., assignor of one-half to H. Carter. Contains a platform with electrocuting terminals.

1,052,975. Switch-Jaw. C. B. Schoenman, Wilkinsburg, Pa. The jaw for a knife switch is held to the panel by a special stud.

1,052,987. Thermostatic Switch. A. E. Weed, Berkeley, Cal. Is actuated by the expanding core of a heating unit.

1,052,989. Rent-Collecting Means for Telephone Service. R. Yearneau, Clark, S. D. Has electric indicating contacts for different coins.

1,052,992. Chandelier. W. Adams, San Francisco, Cal. The reflector shell is pivoted so it can be made into an indirect or direct fixture.

1,052,997. Electric Heater. W. Barstow, San Francisco, Cal. Has a resistance coil at the bottom of an open pipe.

1,052,998. Automatic Electric Heater. L. S. Besley, Salt Lake City, Utah. The heating element in a tubular casing is connected with a thermostatic diaphragm and switch.

1,053,022. Electric Switch. J. M. S. Fontecha, Mexico, Mex. A motor-starting switch which throws the current through the fuses in running position only.

1,053,026. Electric Alarm Clock. F. Goss, Millicent, So. Aus., Australia. Has a variety of contacts to provide alarms of different durations.

1,053,038. Signaling System. J. M. Johnson, Ishpeming, Mich. Electric lamp signals for elevators.

1,053,042. High-Speed Telegraph System. C. Kinsley, Chicago, Ill. Strong and weak current impulses are sent over the line, thus energizing respective printing-circuit relays.

1,053,048. Selective Telephone Call System. O. N. Lindsey, Senatobia, Miss., assignor of three-tenths to J. W. Hall. Includes special selectors for cutting off all stations but the one called.

1,053,061. Rotary Compressor for Wire-Covering Machines. H. L. Owen, assignor to General Electric Co. For applying flocculent asbestos fiber as an insulation.

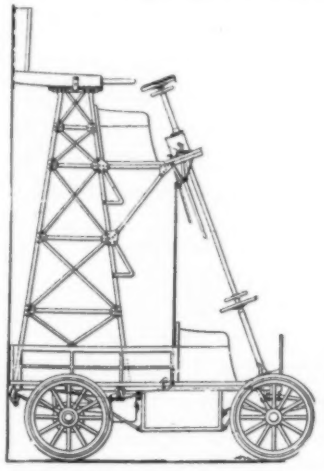
1,053,062. Motor Car. A. Palmros, assignor to Jeffrey Manufacturing Co., Columbus, O. Relates to the framing of an electric mining locomotive.

1,053,076. Electrical Water-Heater. F. Walker, Los Angeles, Cal. Has resistance coils inside of and outside of an insulating tube.

1,053,080. Lamp-Trimmer's Wagon. E. R. Whitney and E. S. Hare, assignors to Commercial Truck Co. of America, Philadelphia, Pa. An electric tower wagon that can be controlled either from the regular or the elevated seat.

1,053,085 and 1,053,086. Recording Device. E. S. Cole, New York, N. Y. An electric drum recorder for fluid pressure.

1,053,096. Electric Fuse and Cutout. J. S. Johnston, assignor to Johnston Manufacturing Co., Utica, N. Y. A magazine fuse-cartridge carrier that can be rotated and moved to throw



1,053,080.—Electric Lamp-Trimmer's Wagon.

out a blown fuse and replace it with a new one.

1,053,098. System for the Transmission of Electrical Energy. C. D. Lanning, Boston, Mass. For reinforcing telephonic currents through series action.

1,053,107. Apparatus for Generating Alternating Currents. J. L. Milton, Chicago, Ill. Has a four-arm rotating inductor.

1,053,108. Means for Applying Coverings to Wires. H. L. Owen, assignor to General Electric Co. A reel of ribbon having a web of flocculent asbestos fiber detachably supported thereon.

1,053,110. Apparatus for Regulating the Pressure in Step Transformers. R. Richter, assignor to Maffei-Schwartzkopff Werke G. M. B. H., Berlin, Germany. Includes a multitap transformer, an auxiliary transformer and an induction regulator.

1,053,111. Electric Bell. W. E. Russell, Danbury, Conn. Is actuated by the reciprocating plunger of an electromagnet.

1,053,116. Electrical Announcing Attachment for Cash Registers. T. J. Sullivan, New York, N. Y. Includes an electric motor, a series of electromagnets and various electric bells.

Reissues.

13,526. Insulator. W. H. Kempton, assignor to Johns-Pratt Co., Hartford, Conn. Original No. 904,069, dated Nov. 17, 1908. A strain insulator with two longitudinal sections joined by a cylindrical casing.

13,529. Insulating Bushing. C. H. Thordarson, Chicago, Ill. Original No. 962,726, dated June 28, 1910. A tubular headed bushing with a threaded sleeve about its stem.

13,530. Electric Welding-Machine. F. Warren, assignor to Toledo Electric Welder Co., Cincinnati, O. Original No. 1,046,240, dated Dec. 3, 1912. Has a number of water-cooled dies.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired February 18, 1913.

554,656. Telephony. F. R. Colvin, New York, N. Y.

554,664. Means for Supporting and Insulating Electric Conductors. T. Eckert, New York, N. Y.

554,671. Heat-Regulator. E. Frischknecht, New York, N. Y.

554,681. Means for Utilizing Currents of Rivers. J. G. Harntges, Buffalo, N. Y.

554,716. Electrical Connecting-Cord. C. H. McEvoy, Lowell, Mass.

554,719. Conduit Electric Railway. W. Oesterlein, Cincinnati, O.

554,723. Insulator. E. Peloubet, Alexander, Ark.

554,759 and 554,760. Electric Battery. C. Willms, Baltimore, Md.

554,761. Electric Battery and Method of Sealing Battery Cells. C. Willms.

554,766. Electric Clutch. A. Briggs, Niagara, Canada.

554,818 and 554,819. Electric Door-Operating Apparatus. O. H. Hicks, Chicago, Ill.

554,821. Electromagnet. J. Houlehan, Chicago, Ill.

554,836. Machine for Connecting Electric Conductors. H. J. Savory, Somerville, Mass.

554,859. Rail-Bond for Electric Railways. R. C. Brown, Somerville, Mass.

554,862. Means for Recording and Reproducing Impulses. W. H. Cooley, Brockport, N. Y.

554,868. Electrically Operated Railway-Track Switch. F. H. Harriman, Hartford, Conn.

554,884. Manually Controlled Electric Block-Signal System. A. G. Leonard, New York, N. Y.

554,889. Fire-Alarm-Telegraph System. J. F. Mehren, Chicago, Ill.

554,895. Telephone. W. H. Russell, New City and G. E. Russell, Little Falls, N. Y.

554,910. Electric Heater, Resistance or Rheostat. P. B. Delany, South Orange, N. J.

554,918. Electric Circuit-Closer and Breaker. J. S. Farmer, St. Louis, Mo.

554,949. Rail-Bond for Electric Railways. S. Nikoloff, Worcester, Mass.

554,955. Insulator for Electric Wires. M. Riera, Havana, Cuba.

554,962. Electromagnetic Induction System of Propulsion. A. C. Shuttleworth, Philadelphia, Pa.

555,056. Galvanic Battery. E. L. Slocum, Pawtucket, R. I.

555,057. Electric Lighting System. E. L. Slocum.

555,058. Galvanic Battery. E. L. Slocum.